Saskatchewan
Energy and Mines

Energy, Mines and
Resources Canada

Énergie, Mines et
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Canada - Saskatchewan Renewables — Conservation Demonstration Program

Final Report

CANADA-SASKATCHEWAN CONSERVATION AND RENEWABLE ENERGY DEMONSTRATION AGREEMENT

On March 18, 1980, the governments of Canada and Saskatchewan entered into a Conservation and Renewable Energy Demonstration Agreement. The Agreement, which terminates March 31, 1984, funds the development and demonstration of a wide range of conservation and renewable energy technologies. The program is funded on an equal cost-shared basis by Canada and Saskatchewan, and is administered by Saskatchewan.

The objectives of CREDA are:

— To develop and demonstrate promising new technologies which exploit renewable energy resources, conserve energy, or make its use more efficient;

— To create employment in new or existing industries;

— To develop broad public awareness of the potential of renewable energy and energy conservation technologies.

This report outlines the results of a project funded by the Government of Saskatchewan as represented by Saskatchewan Energy and Mines, and the Government of Canada as represented by Energy, Mines and Resources Canada, under the terms of the Renewables-Conservation Demonstration Program, and contracted with the party identified herein.

However, neither the Government of Saskatchewan as represented by Saskatchewan Energy and Mines, nor the Government of Canada as represented by Energy, Mines and Resources Canada, accept liability for any errors, omissions, or inaccuracies that may; be included in or derived from this report, nor do they assume any liability with respect to the use of, or actions resulting from the use of, any information contained in this report.

SASK. 35

Retrofit: Swift Current Recreation Centre

Retrofit of Recreation Facilities Project — Phase II

Final Technical Report
on a Renewables-Conservation Demonstration Program Project

Conducted By

Saskatchewan Culture and Recreation
and the City of Swift Current

And Supported By

Saskatchewan Energy and Mines
and
Energy Mines and Resources Canada

Project Leader: Cecil Nobes

Miscellaneous
Report FP-38

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Revised August 26 1982

RETROFITTING OF EXISTING

RECREATION FACILITIES PROJECT

PHASE 1

SWIFT CURRENT ARMOURIES
CONVERTED TO A RECREATION CENTRE

INTRODUCTION

1. The Program

This investigation and study was carried out by de Lint/Huckerby Architects and Engineers under the auspices of the Saskatchewan/Canada Renewables-Conservation Demonstration Program.

The purpose of this Study is generally to conduct a detailed energy analysis of the facility, identify energy losses and propose solutions to these losses in five retrofit categories:
a) no cost retrofit- maintenance and operating changes (this has been assumed to cost less than $1,000)
b) low cost retrofit - minor changes to structure or mechanical /electrical systems requiring low capital investments (assumed at less than $5,000)
b) low cost retrofit - changes to structure or mechanical/electrical systems requiring moderate investments (assumed at less than $25,000)

d) high cost retrofit -changes to structures and or mechanical/electrical systems requiring significant capital investments (assumed at over $25,000)
e) new and innovative retrofit techniques - changes to systems or solutions which are not "tried and proven" but which potentially offer cost effective savings to the energy consumption of the facility.

2. Facility History:

The Swift Current Recreation Centre, as it is presently known, was built about 1951 as an armouries building. Although energy conservation was not a prime consideration in those days, the quality of construction was sound and this reflects in the general state of the building some 30 years later.

In 1968 the armouries was taken over by the City of Swift Current and converted to a Recreation Centre. Certain modifications were done because of the change of occupancy type to meet fire codes. The boiler was replaced , and general improvements (new windows, etc.) have been undertaken on an on-going basis.

3. Building Description:

The Swift Current Recreation Centre consists of the following general areas (see floor plans and list of activities attached)

a) Large central gymnasium (former drill hall)
   - this area is used for numerous court sports such as badminton, tennis, volleyball and basketball.
   - dances, conventions, car shows, boat shows, "Las Vegas" nights etc. are also held in the gymnasium area.

b) Parks Division Vehicle Maintenance and Storage Garage
   - this is located at the north end of the building at the main floor level. Presently five large overhead doors cover the north wall.

c) East "Annex" (main floor)
   - a pottery and craft room as well as a small card room/meeting room are located in this annex.
   - the janitor's room is located here as well as a room which is leased to the Cubs/Scouts.

d) West "Annex" (main floor)
   - these areas are totally utilized by the Cadet Corps for offices, storage, etc.

e) Lower Lounge (main floor - south end)
   - because of the small kitchen, this area is used to serve small groups (hot-dogs, etc.)
   - meetings and some crafts take place here
   - other general recreational uses.

f) Lecture Room (second floor - north end)
- the Cadet Corps have their offices in this area
- the judo club also uses this area as a club room (mats are left down on a permanent basis).

g) Upper Lounge (second floor - south end)
- because this is a large lounge, this area is used for larger groups (dance classes, etc.)
- two toilet and washroom wings are located adjacent the upper lounge on the east and west sides.

h) Rifle Range (basement)
- this area is utilized as a rifle range for the Cadet Corps, for gun safety instruction and for archery.

i) Shower and Locker rooms (basement)
- these rooms are used generally by participants of all sports as required.

j) Boiler Room (basement)
- the central heating system for the building is located in this area.

4. Existing Mechanical System:

The existing mechanical systems that involve the use of energy include the heating system, the domestic water heater, and the exhaust systems. The building does not contain a ventilation system at this time.

The existing heating system consists of a natural gas-fired steam boiler, Burnham America Model 616, 1,800 MBH input, operating at 5 psi steam pressure. The distribution system consists of a 2-pipe steam and condensate system complete with convectors, fan coil unit, unit heaters - both projection type (Gym Area) and horizontal type (Garage Area) and a condensate receiver and pumps.

The boiler is relatively new, having been replaced within the last ten (10) years, and the remainder of the heating system would appear to be well maintained and in good condition.

The heating sytem is controlled by steam pressure, the boiler automatically maintaining approximately 5 psi pressure in the steam supply header. The temperature control system within the building is basically manual with dampers and hand valves being used to control convector output and manually turning the projection heater fans (Gym Area) off and on from a breaker panel. The only automatic temperature control system is provided by the four (4) electric thermostats located in the Garage Area and rear Mezzanine Area.

Domestic Hot Water:

The domestic water heater consists of a storage tank type, natural gas-fired unit, and serves the washrooms and the locker rooms.

Exhaust System:

The Washrooms are complete with small exhaust fan systems tied into the light switches, however, the basement locker rooms are exhausted by means of a commercial type fan located in a ground floor storage room. The fan operation is manually controlled by a wall switch located in the same storage room.

5. Building Construction:

a) Basement and Foundations:

- the basement walls and floors are of concrete construction.
- the building foundation consists of strip footings.

b) Main Gymnasium Area:

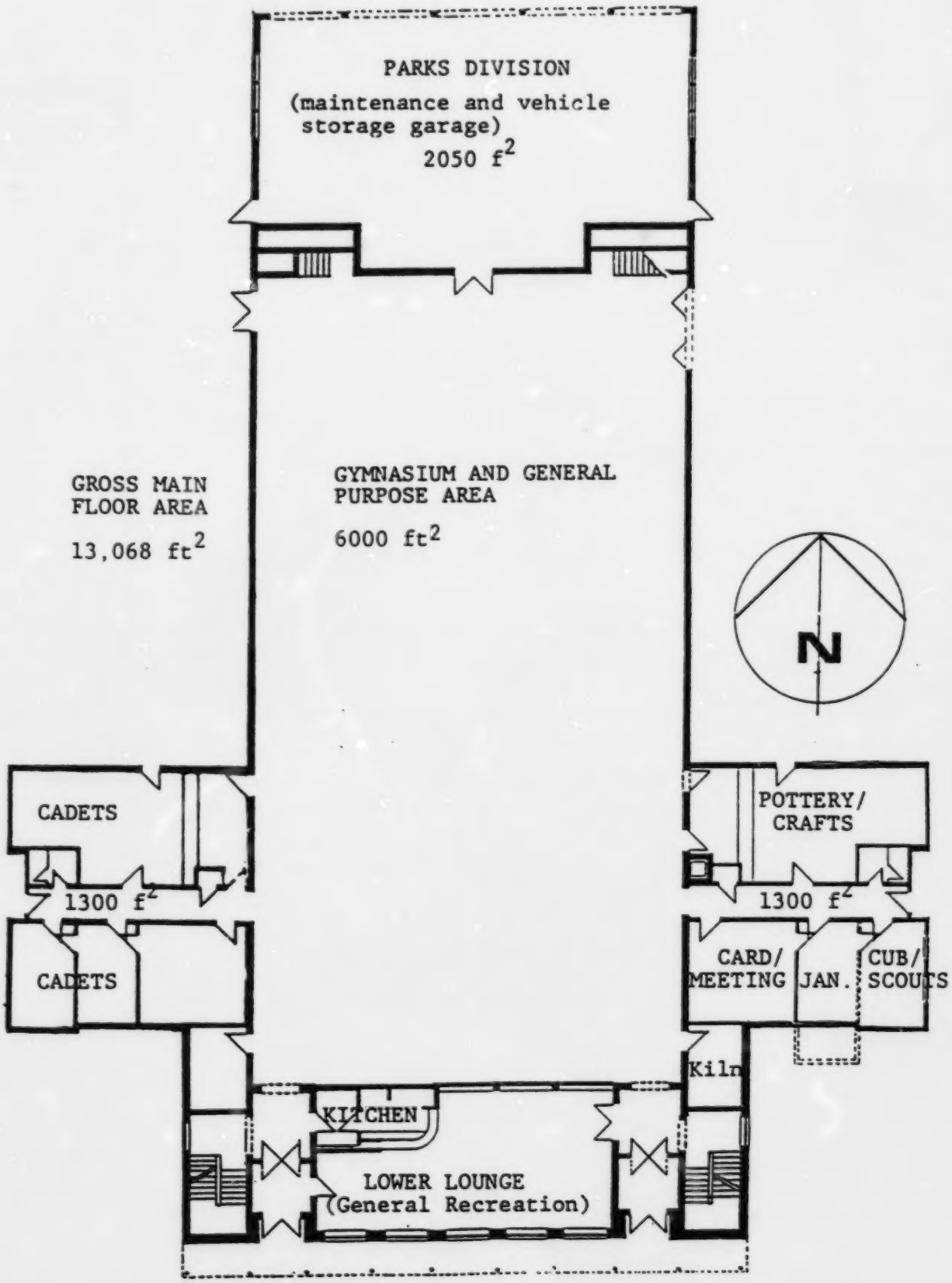
- the main gymnasium area walls are concrete block and brick exterior with no evidence of insulation. R = 1.92 Roof 1" insulation over 1.75" wood decking R = 6.83.

c) Lounges:

- the lower lounge exterior walls are concrete block and brick with possible interior insulation.
- the upper lounge exterior walls are concrete block and stucco with possible interior insulation.

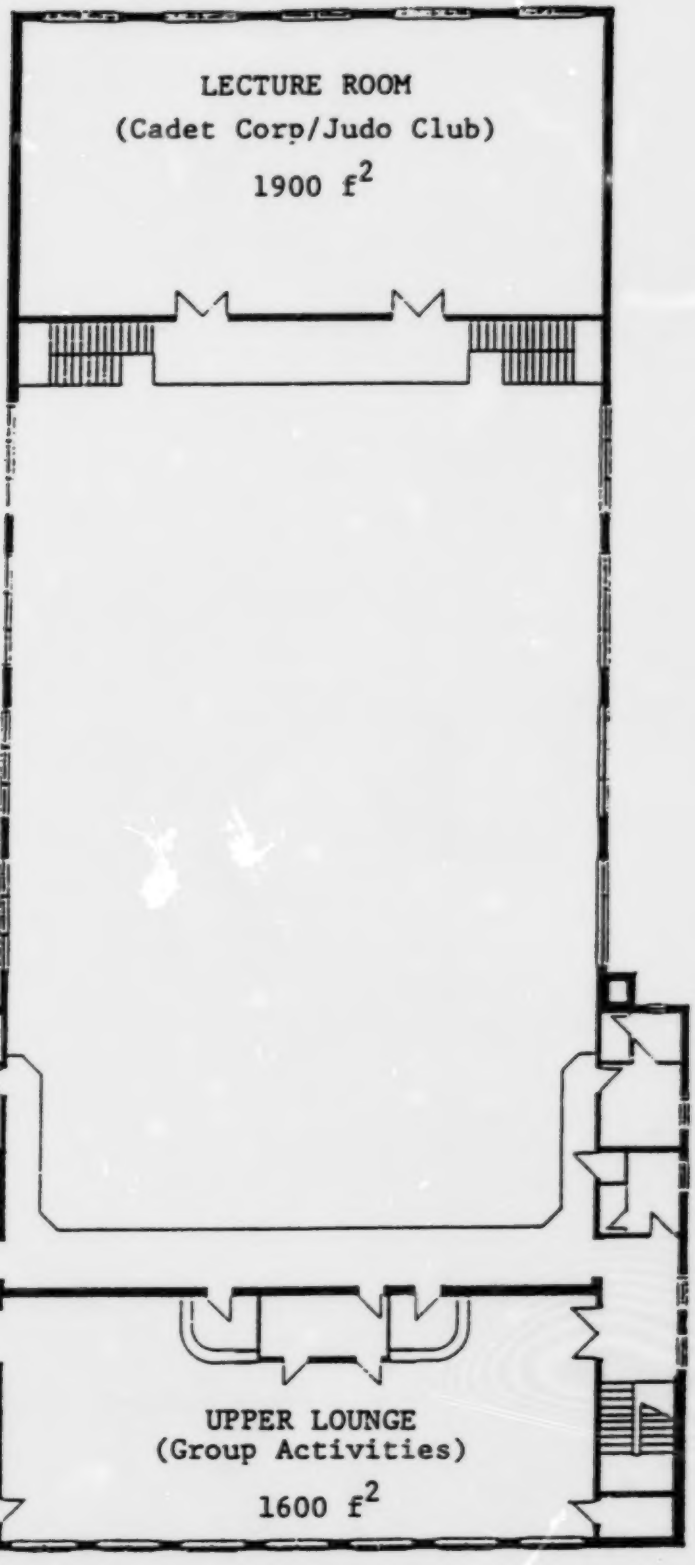
d) Annexes:

- the "annex" exterior walls are wood stud construction with stucco and interior insulation. R = 8.16 Roofing 2" insulation and 7/8" T & G decking R - 6.83.



SWIFT CURRENT ARMOURIES
Ground Floor Plan

PRESENT UTILIZATION



GROSS
SECOND
FLOOR AREA
4,422 ft^2

SWIFT CURRENT ARMOURIES
Second Floor Plan

PRESENT UTILIZATION

UTILIZATION

Extracts from Report
by
Recreation and Parks Department
to
City of Swift Current
for February 1982.

Recreation Centre	February 1982	February 1981
Attendance for Feb. 1982	3,181	3,669
Total to Date, Feb. 28, 1982	6,110	7,435

Some of the events, activities and programs taking place at the Recreation Centre in February would include:

- Badminton
- Jogging
- Alfred Cooper Club
- Archery
- Frontier City Pistol Club
- Swift Current School of Dance
- Army Cadets
- Aerobic Dance
- Singles Parents Club
- Wildlife Federation
- Indoor Soccer
- Minor Hockey Meeting
- Lions Club meetings
- Forresters Annual Meeting
- Union Hospital Psychiatric Ward
- N.D.P. Meeting
- Junior Hunter Safety
- Woolworth's Staff Party
- Afternoon card players
- Swift Current Women's Institute
- Ukrainian Dancers
- Judo
- Ladies Volleyball
- Frontier City Weights Away
- Indoor Tennis
- Air Cadets
- Sea Cadets

- Irwin Collegiate Club Time
- Art Show & Sale
- Merchants Fastball Meeting
- Art Classes
- C.J.G.L. Volleyball
- Rock Hounds
- Foster Parents Association
- Image West Photography
- Karate Club

In addition to the above, ample time is set aside for informal, unstructured used of the gymnasium, rifle range and other areas and equipment.

ENERGY CONSUMPTION:

The natural gas used to heat the building and the domestic hot water for the year 1981 totals 56,727 cubic meters or 586,557 kWh.

The electrical energy used to operate the building over the same period of time totals 58,621 kWh.

The total energy consumption for the year 1981 comes to 645,178 kWh.

The total building floor area made up of - 4,422 ft^2 mazzanine, 13,068 ft^2 ground floor, and 3,040 ft^2 basement area, totals 20,530 ft^2.

Using 1981 as an example, the total energy used was 31.43 $kWh/ft^2/year$. This figure is relatively low, in that, buildings vary from a low of approximately 20 $kWh/ft^2/year$ (modern super insulated) up to a high of 100 $kWh/ft^2/year$ or higher.

Although we do not have information on Energy Consumption in other Armouries in this area, typically schools and commercial buildings in the Regina/Moose Jaw area have been using energy at the rate of between 30 to 45 $kWh/ft^2/year$.

With this in mind it would indicate that the building is being operated near the low end of the Energy Consumption Scale, which makes meaningful energy conservation more of a challenge. In any event, we have listed the following items which we feel will reduce energy consumption by the mechanical system.

ENERGY CONSUMPTION - 1981

NATURAL GAS

February	9380 cum.	$ 808.63
March	9179	791.42
April	6474	559.87
May	3168	280.98
June	783	75.82
July	444	44.77
August	168	20.43
September	123	15.65
October	548	57.36
November	5025	492.12
December	8760	859.09
January/82	12675	1,232.64
	56727 cum.	$5,238.78

ENERGY CONSUMPTION - 1981

ELECTRICITY

To March '81	21076 KWH	$ 526.90
June '81	8520 KWH	$ 255.60
Sept.'81	13065 KWH	$ 391.95
Dec. '81	15960 KWH	$ 478.80
	58621 KWH	$ 1,653.25

CODES AND STANDARDS

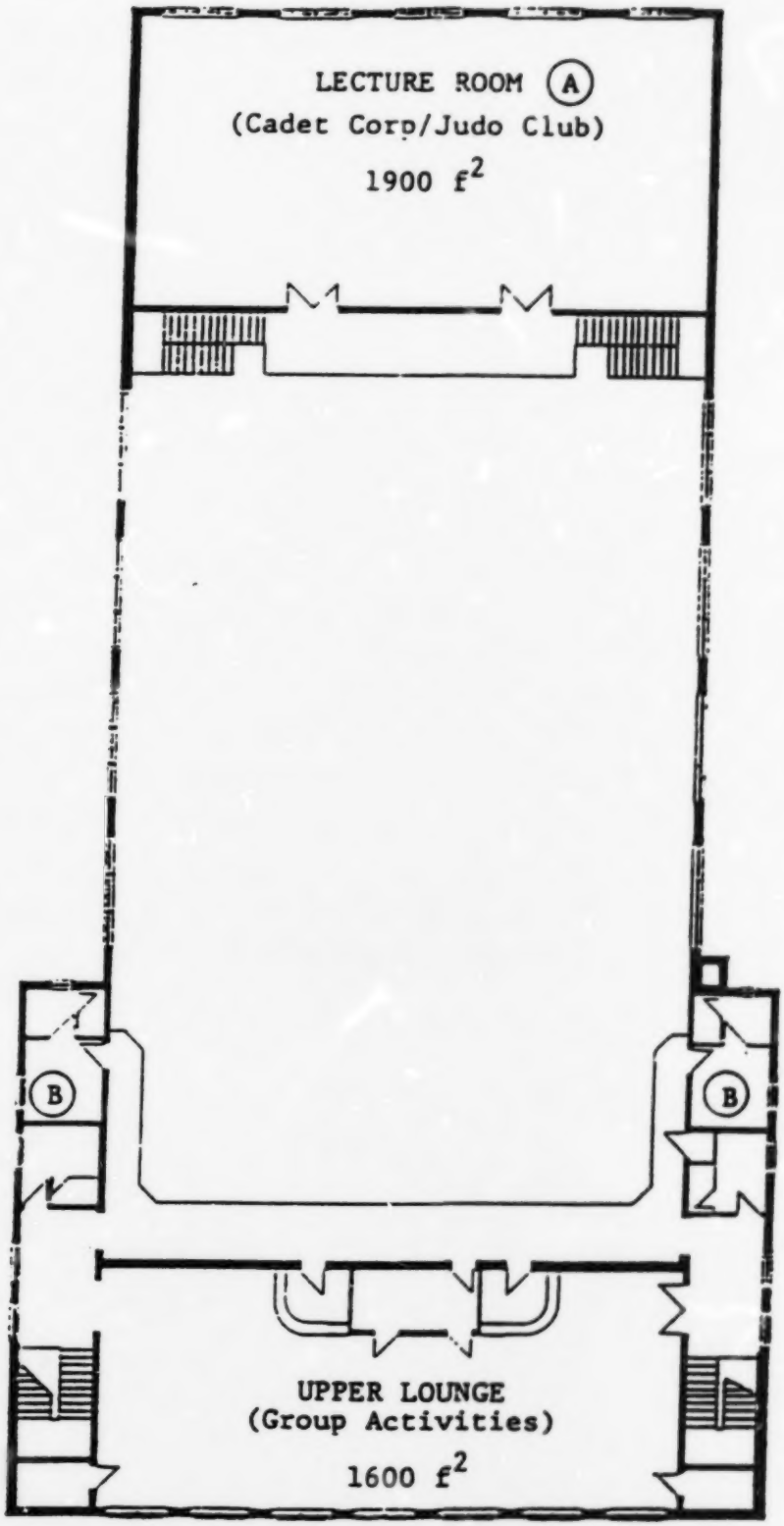
On our site visit to the building, we assessed the suitability of this project with respect to both fire and accessibility standards.

Fire Codes:

It is our opinion that from the visual inspection carried out, this building seems to fully comply with the standards currently in force. There seem to be sufficient fire exit units and stair access. The only two areas of possible concern are the mezzanine areas - and in this regard we have two areas in particular: the north judo and meeting room area, identified as (A) on plan, which have to exit through the major gymnasium, and the two toilets identified as (B), which have to exit over a mezzanine balcony. It would seem that the storage area for vehicles, identified as (C) on the ground floor plan, may require some additional safeguards as to the storage of inflammible and explosive materials.

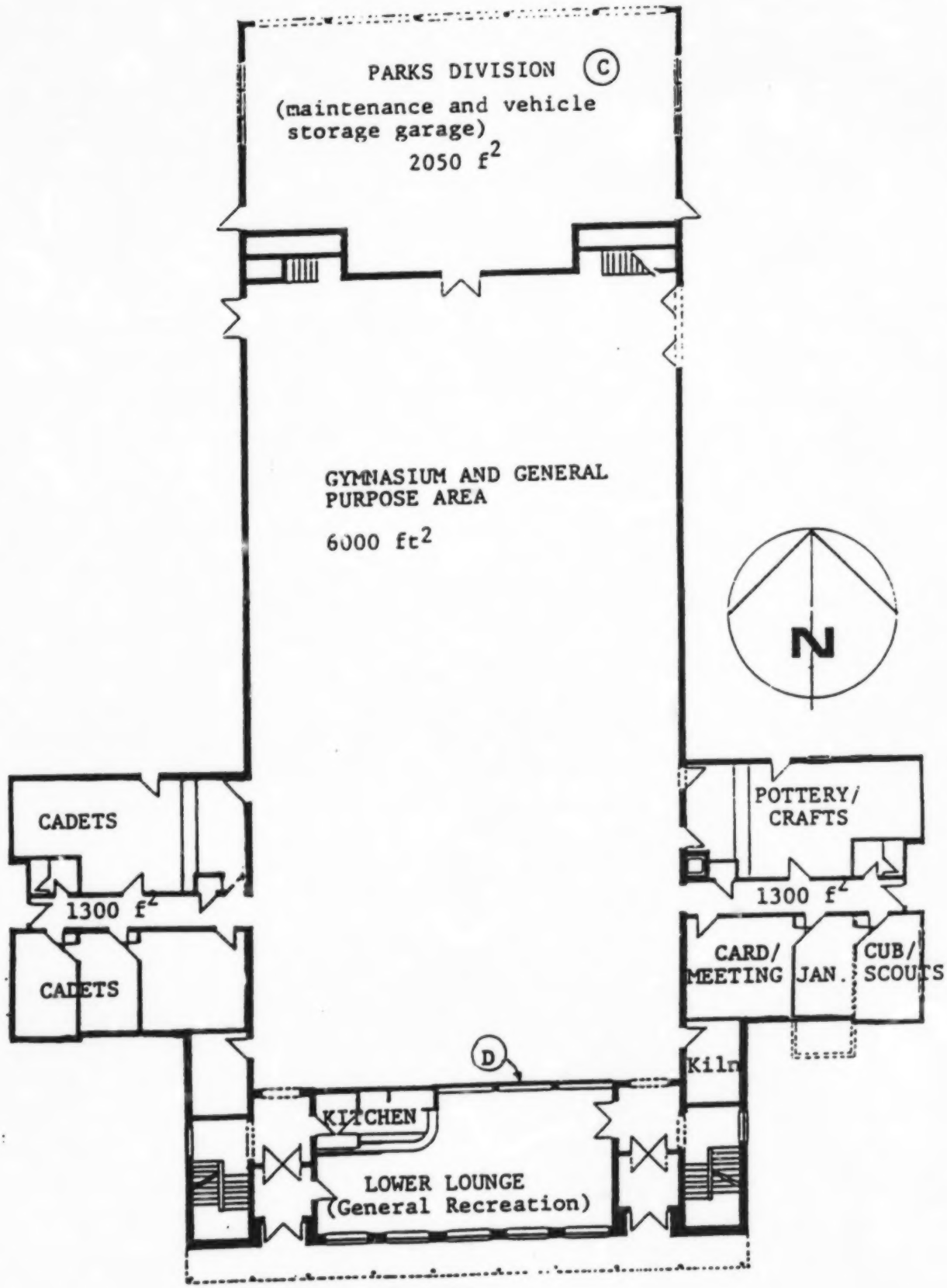
With respect to the accessibility standards, it must be noted that of course the upper floor and the washrooms do not meet the Saskatchewan Accessibility Standards.

We also noticed that an hazardous condition exists with respect to the glass block wall situated between the main gymnasium area and the lounge which we have identified as (D) on the attached ground floor plan. The writer cut his hand on one of the broken glass blocks (on the lounge side). We strongly urge the operators of the facility to remove these glass block units and replace them with either concrete block or another suitable material which can withstand the impact loading.



SWIFT CURRENT ARMOURIES
Second Floor Plan

PRESENT UTILIZATION



SWIFT CURRENT ARMOURIES
Ground Floor Plan

PRESENT UTILIZATION

NO COST RETROFIT

A. ARCHITECTURAL

We feel that a good maintenance program should reduce the Energy Consumption Cost (E.C.C.), although admittedly one can not possibly anticipate the amount with any degree of accuracy.

In the thermal scan assessment of the Swift Current Armouries building we feel that although the facility shows very little leakage (see Appendix 1) the following should be considered:

1. Weatherstripping at the openings can be improved.
2. We would also suggest some caulking at window and door frames.
3. We would suggest that since 5 overhead doors at the north area are somewhat of a luxury, two of these doors be strapped and insulated to the interior. The cost of this work should not exceed $600 (see plan drawing page 23.
   Potential annual saving 47,479 MBTU representing a cost of $125. Direct payback would be about 5 years.
4. We would further recommend that the exposed heat pipes be furred in in the present card room, since continued exposure will conflict with the proposed system. The cost of this item should not exceed $250 (see plan drawing page 23.
   No payback period estimated but this will greatly increase the comfort level in the adjacent rooms.

B. MECHANICAL:

1. Garage Area Operating Temperature: This area is heated with two horizontal type team unit heaters. During a site visit during winter conditions it was noted that the thermostats controlling the unit heaters in question were set at between 75°F and 80°F.

   We feel that the temperature within the Garage Area could be reduced considerably, we feel that 40°F would be a reasonable temperature during unoccupied times and 60°F when the Garage Area is being used as a work shop.

2. Locker Room Exhaust Fan: At present, in order to turn the fan on or off it is necessary for the operator to crawl over some ductwork to get access to the manual switch.

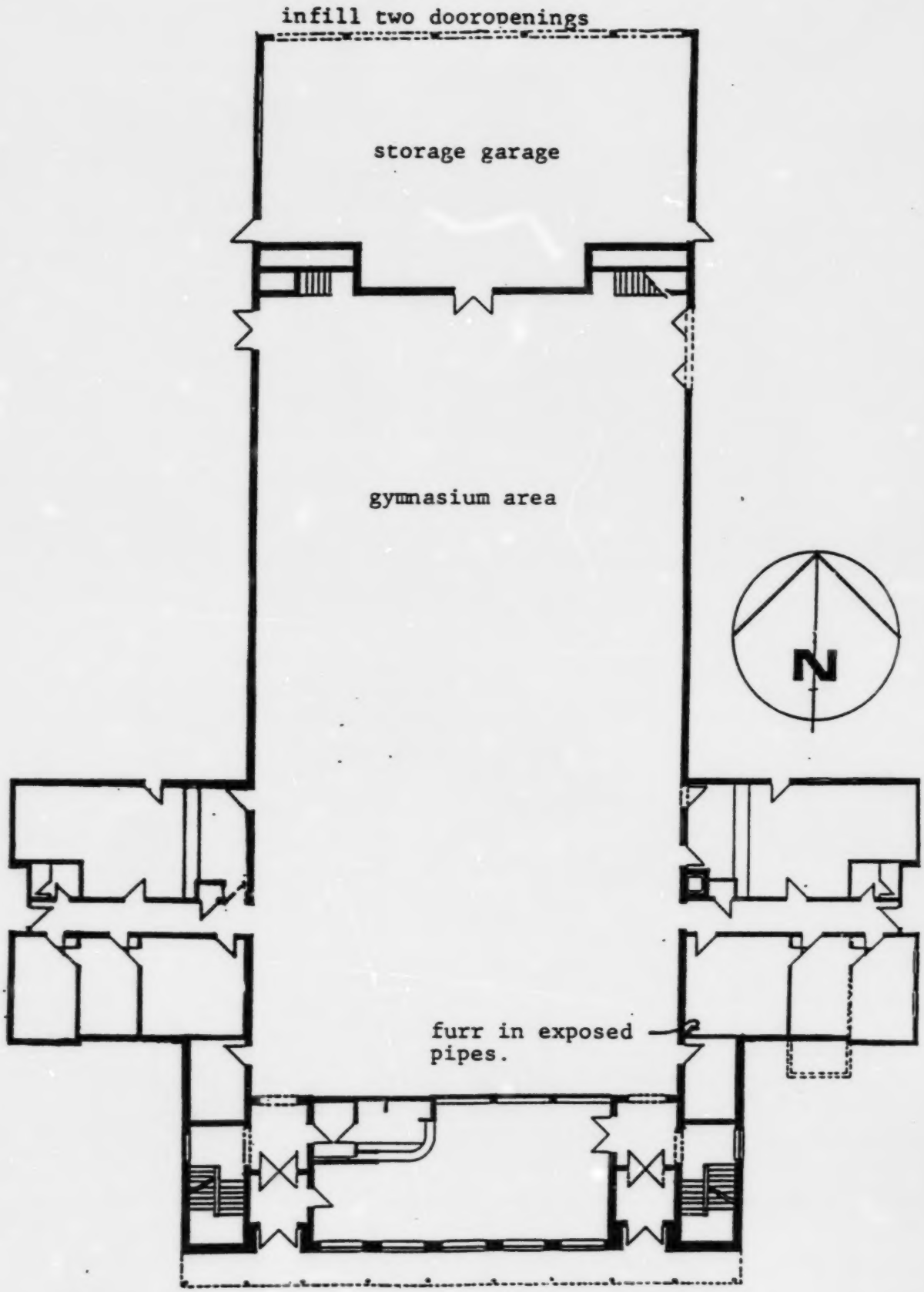
   This would appear to be a very inconvenient set up and we would suggest that once the fan is turned on and operating that it may run longer than need be. We would suggest that the fan control be changed to a time clock complete with a manual overrride and be relocated to a more convenient spot.

   The cost of this change would be approximately $200 installed.

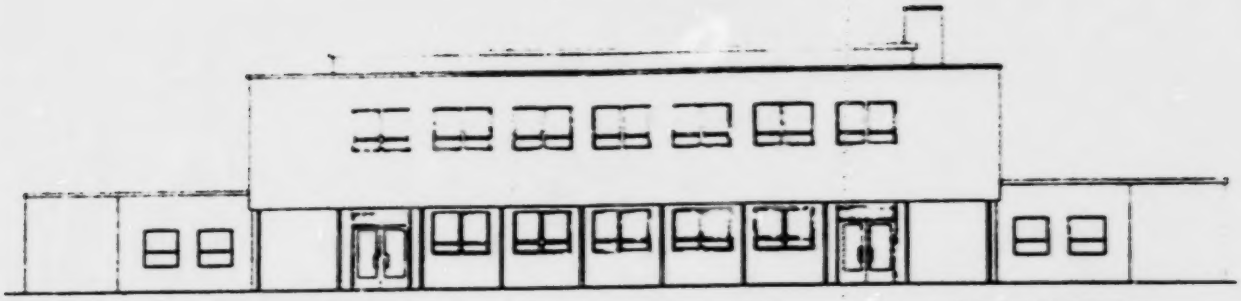
3. Boiler Breeching: In order to reduce warm building air from escaping up the chimney during the period of time that the boiler is not fired, we would suggest the installation of a damper in the boiler breeching.

   The damper would be normally closed and would open only when the boiler was fired.

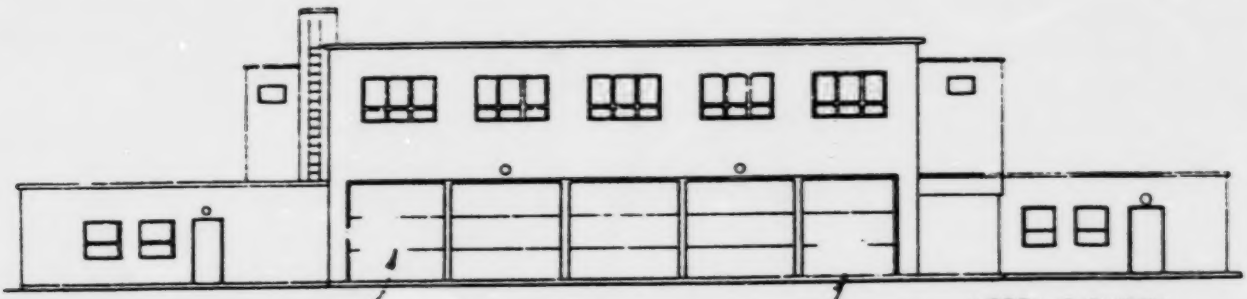
   The cost of this installation would be approximately $500.



SWIFT CURRENT ARMOURIES
Ground Floor Plan
No Cost Alternate

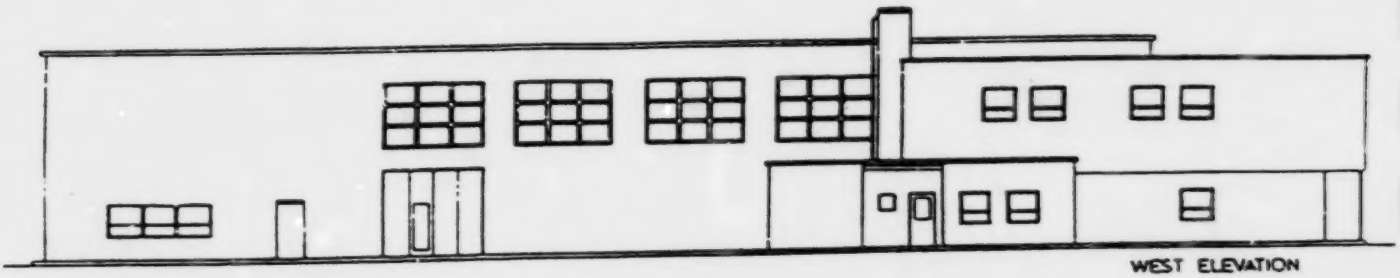


SOUTH ELEVATION

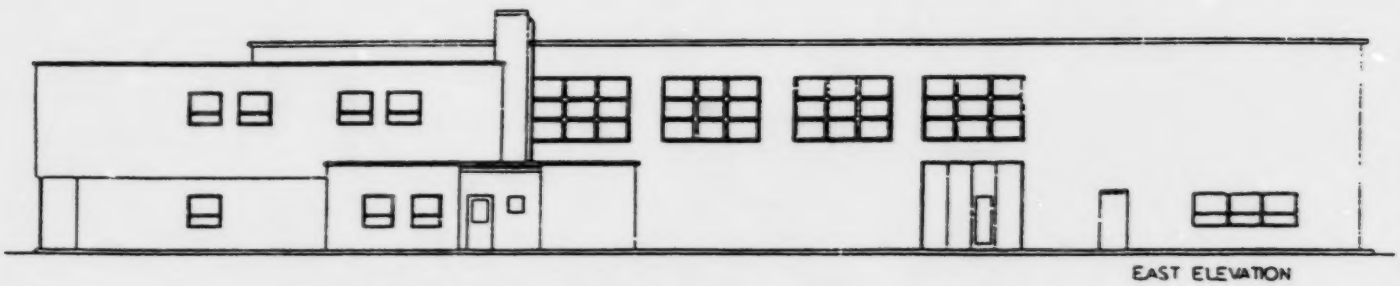


insulate and fill doors (2)

NORTH ELEVATION



WEST ELEVATION



EAST ELEVATION

SWIFT CURRENT ARMOURIES
Elevations
No Cost Alternate

LOW COST RETROFIT

A. ARCHITECTURAL

1. Since the concrete block to the interior of this facility, where it is exposed, is not finished in any way, and whereas one can notice a number of areas where the cement is chalking, we would strongly suggest an oil base paint finish which will also act as a vapor barrier (areas shown as A on attached drawing).

   We would further recommend that these walls be painted with a light colored paint to improve light reflectivity.

2. We would further recommend that to the interior of the south oriented windows horizontal venetian blinds (Levolor or equal) be added. These blinds would have a highly reflective surface. This will reduce direct radiation gain while still assuring sufficient ambient lighting levels during day time hours (see attached plan pager 28/29).

   No payback period estimated for this item, however the comfort level of the upper lounge will be increased by reducing heat gain.

3. To upgrade the large glazed areas in the gymnasium, we would suggest the installation of a white spun insulation and translucent glass fibre reinforced panels (Filon) over the windows which will permit diffused light to penetrate while still maintaining the operation of the windows thus assuring summer ventilation. This work should not exceed a total cost of $4,800, which indicates an annual saving of 174 MCF or $525 and a straightline payback period of 9 years.

4. Attached large scale details show the lack of insulation to the basement walls (also see Thermoscan). We suggest the addition of 2" rigid insulation and ½" plasterboard. This additional work should not exceed $1,050. This measure will save 68 MCF/year or $204 which means a payback period of 5.2 years.

5. To increase the comfort level in the spaces above the boiler room it is recommended that the ceiling of this space be insulated with rigid fibreglas (non-flammable) insulation to a thickness of 2" mechanically fastened. Because of the amount of piping etc. on this ceiling we have not been able to estimate the probable cost accurately.

B. MECHANICAL

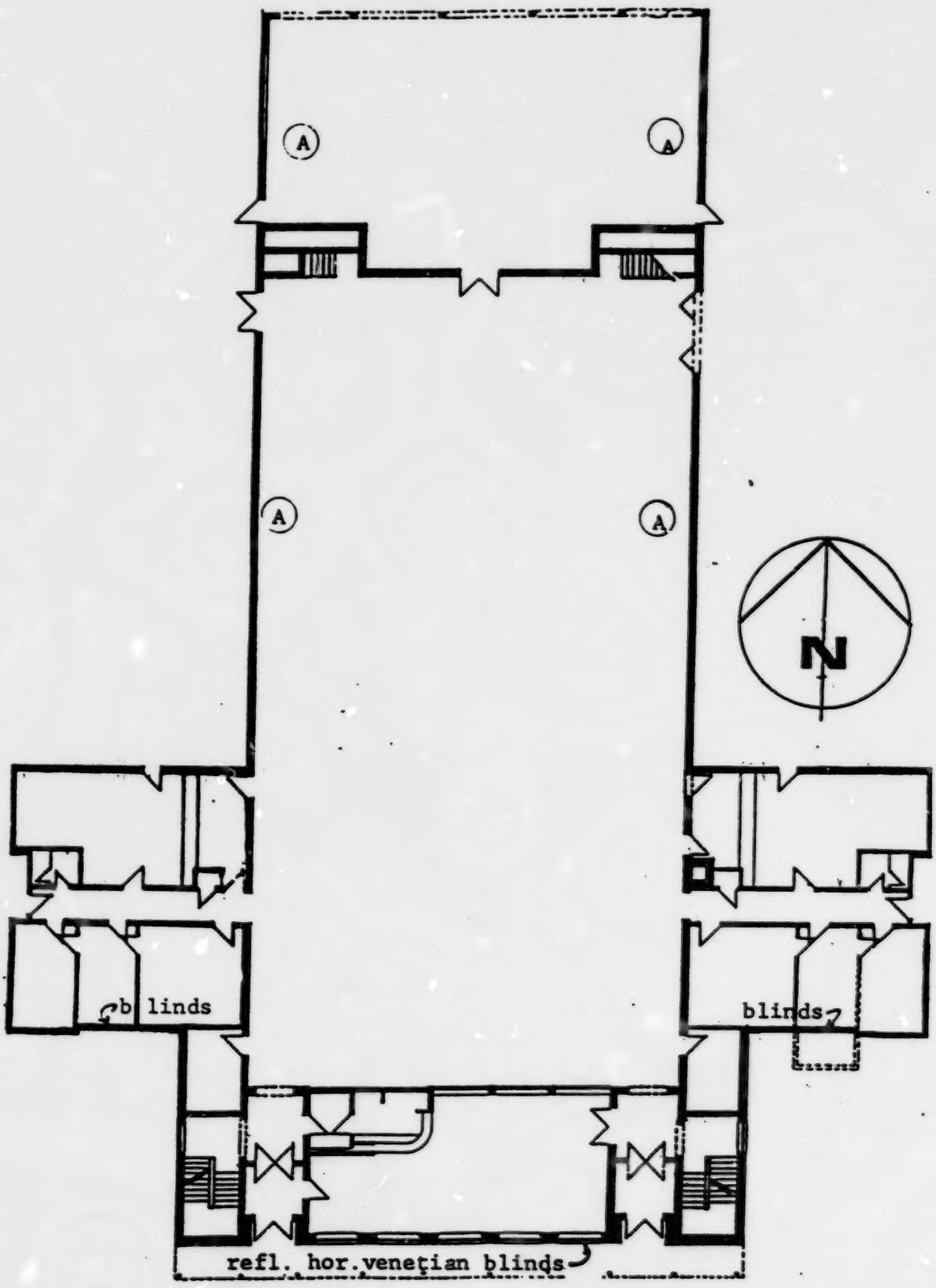
1. Boiler Controls: We would suggest the installation of an indoor/outdoor controller as part of the boiler steam pressure control. The boiler steam pressure would be automatically adjusted relative to the outdoor temperature. The steam pressure would be highest when the outdoor temperature was low and would reduce as the outdoor temperature was increased until the boiler would automatically shut down at a preset outdoor ambient.

   The installed cost of this retrofit would be approximately $1,000.

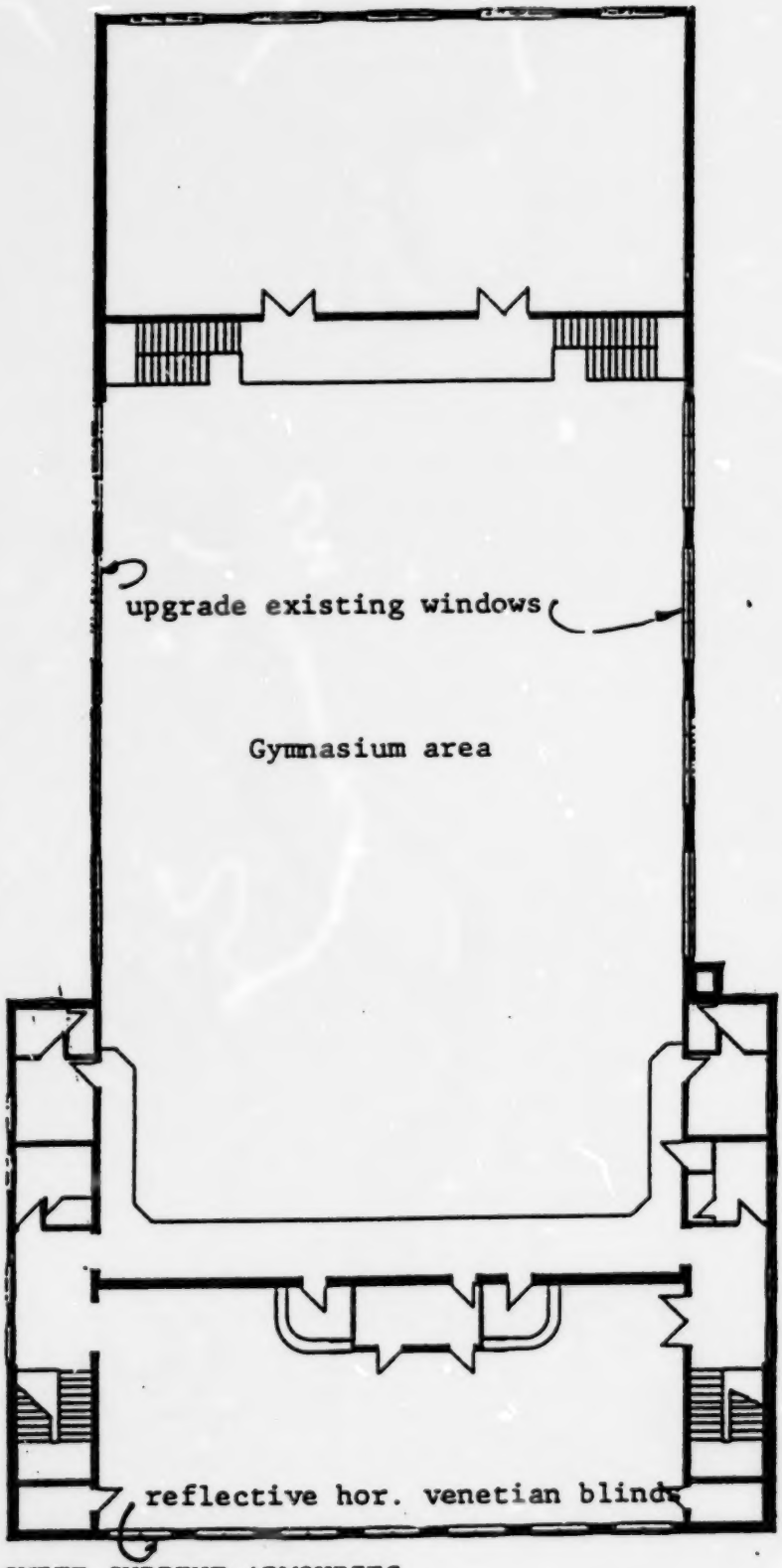
2. Anti-Stratification Fans: We would suggest the installation of four (4) ceiling mounted propeller fans in the Gym Area. These fans would help drive the heat down to floor level that normally collects at or near the ceiling. Because of the 26'0" ceiling height in the Gym Area these fans would be particularly effective. Due to the type of activity associated with sports played in this area the fans will require guards. Also, we would suggest that the fans be complete with automatic controls with a manual override.

   The cost of this retrofit installed would be approximately $3,000.

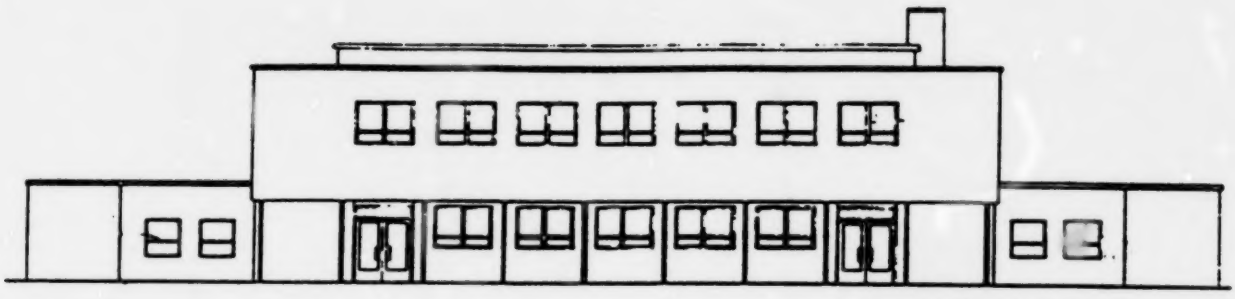
   The fan manufacturers publish a payback period of two (2) years or less for the cost of the fans, however, with the automatic controls and guards as part of the capital cost we feel the payback will be closer to six (6) years based on current costs of energy.



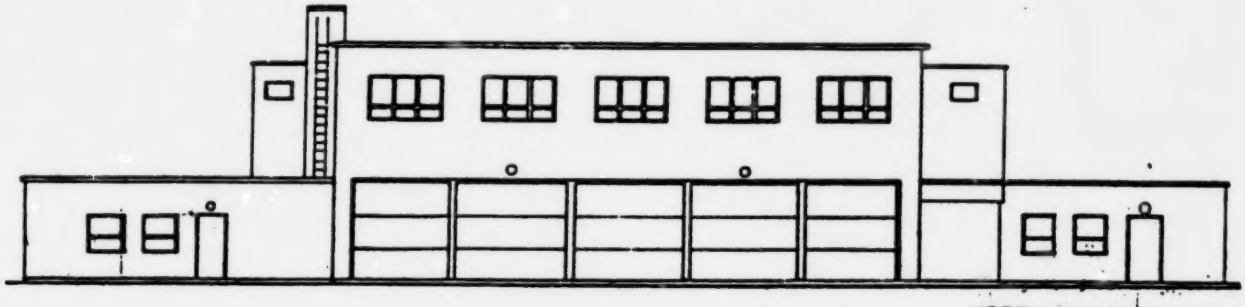
SWIFT CURRENT ARMOURIES
Ground Floor Plan
Low Cost Alternate



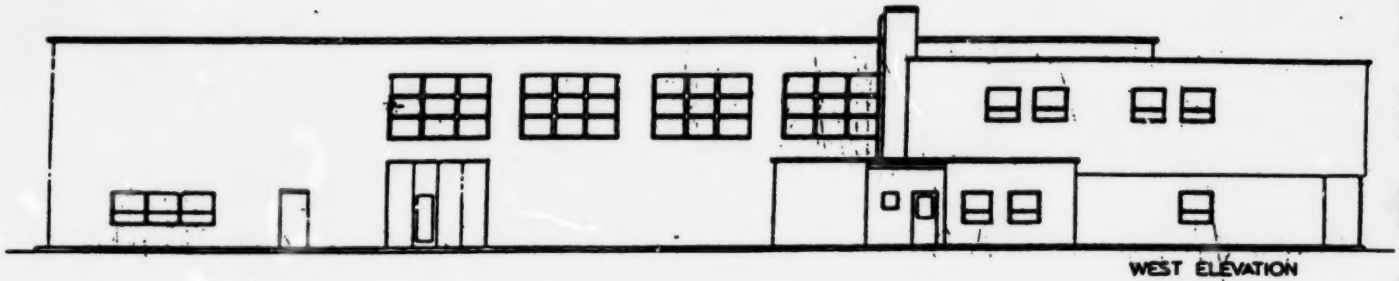
SWIFT CURRENT ARMOURIES
Second Floor Plan
Low Cost Alternate



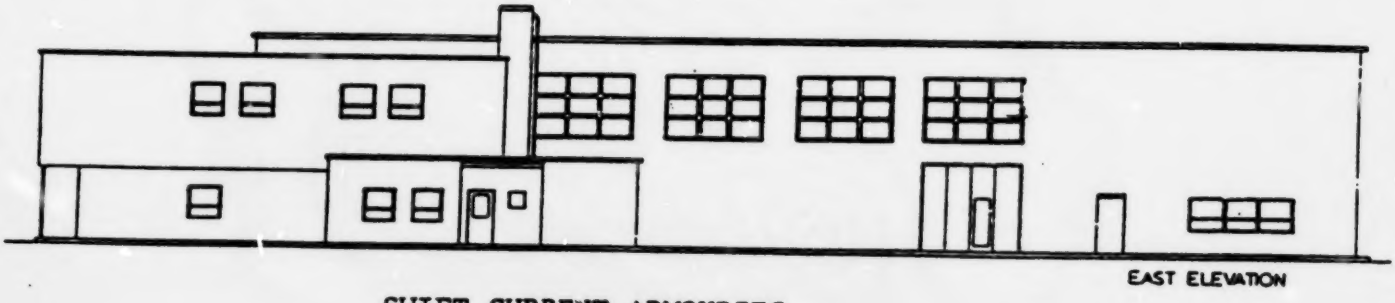
SOUTH ELEVATION



NORTH ELEVATION

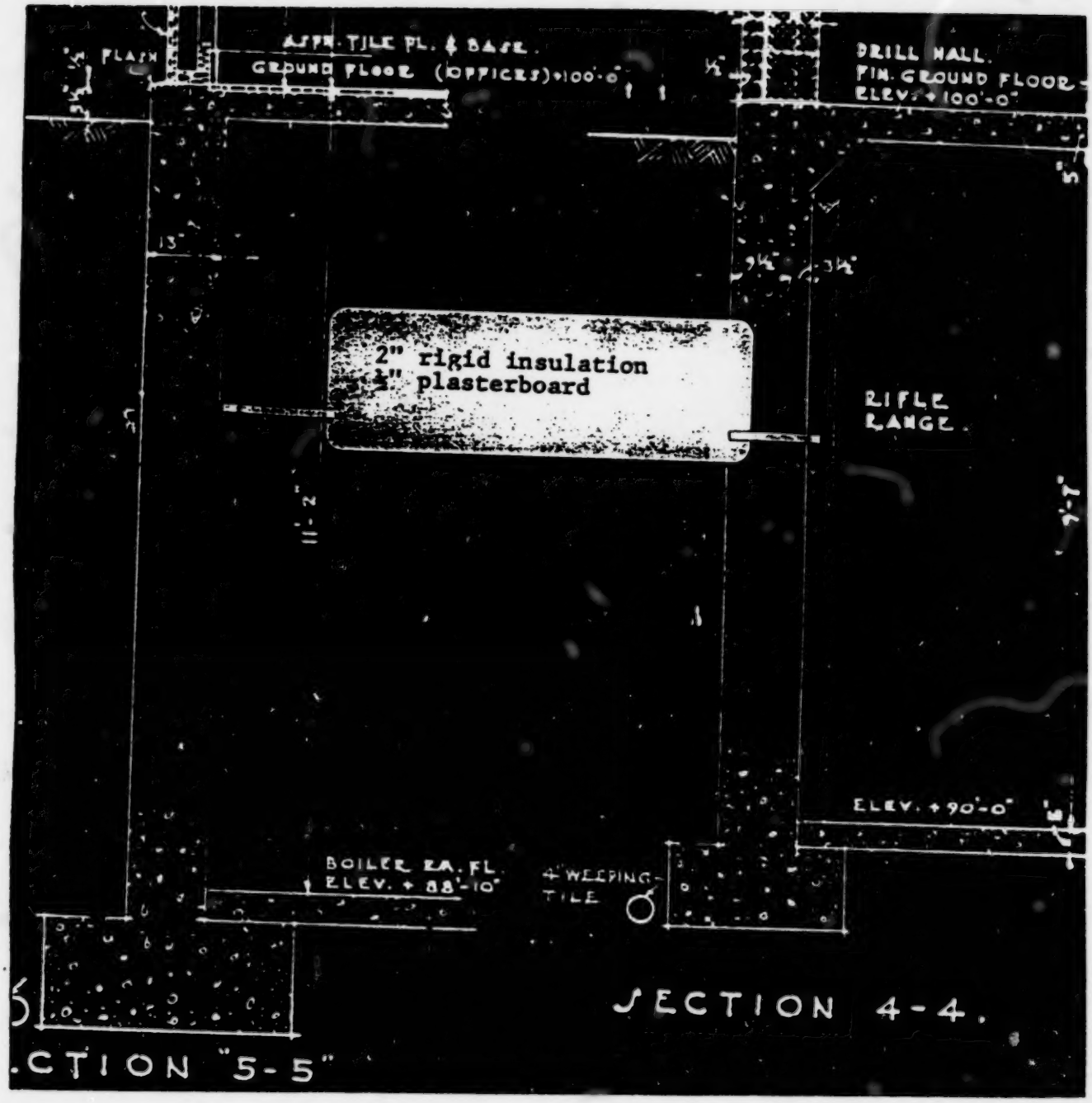


WEST ELEVATION



EAST ELEVATION

SWIFT CURRENT ARMOURIES
Elevations
Low Cost Alternate



SWIFT CURRENT ARMOURIES
Basement wall details
Low Cost Alternate.

MEDIUM COST RETROFIT

A. ARCHITECTURAL

1. To provide permanent sun screening at the upper level lounge, a canopy can be installed as per attached detail. This will all but eliminate the summer heat gain. The total cost of this installation should not exceed $7,000.

   No payback indicated although this measure will aid in comfort level during summer operation.

2. If natural lighting is not required in the operation of the gymnasium and thus a complete reliance on electrical light sources is committed to then it would be advisable to remove the existing windows in their entirety and install 2x3 wood stud infill frames c/w full batt insulation, vapor barrier, exterior stucco and interior plywood. Manually operated ventilation panels to top of units must be installed(or otherwise mechanical ventilation must be provided).
   Cost including ventilators should not exceed $3,075.
   Payback on a potential annual saving of 151,930 MBTU could be 6.75 years.

B. MECHANICAL

1. Automatic Temperature Control System: We would strongly recommend the installation of an automatic temperature control system in all occupied areas of the building. Each room or area would be complete with an electric thermostat with night setback and each heating terminal unit would be complete with a steam control valve and fan switch where applicable.

   This retrofit would cost approximately $7,500 to supply and install and would greatly simplify the operation of the heating system and would improve the comfort level and prevent overheating.

   Once again we find it impossible to accurately calculate a payback period, however, we feel that it would be approximately ten (10) years.

2. Boiler Replacement: Considering the proposed Architectural changes to the building, including additional insulation, we feel that the existing boiler may be oversized. Although the existing boiler is in good condition one method of energy conservation would be to replace the existing unit with a smaller more efficient modular type steam boiler. We would recommend the installation of a cast iron sectional, equal to a 'Hydro-Therm' Multi-Temp. We have chosen a Model MR-1200 (see Appendix 1) for pricing purposes. This unit would cost approximately $6,500 with an additional $4,000 used up for installation for a total of $10,500.

2 Boiler Replacement: (continued)

Previous studies have shown that the energy saved in going with a modular boiler system over a conventional boiler is between 15% and 20%. In our case by going modular and downsizing the boiler, we feel the savings would be closer to 20%. 20% of the 1981 heat costs would be $1000 The payback period would be approximately 10.5 years. if interest rates and energy increases are not considered.

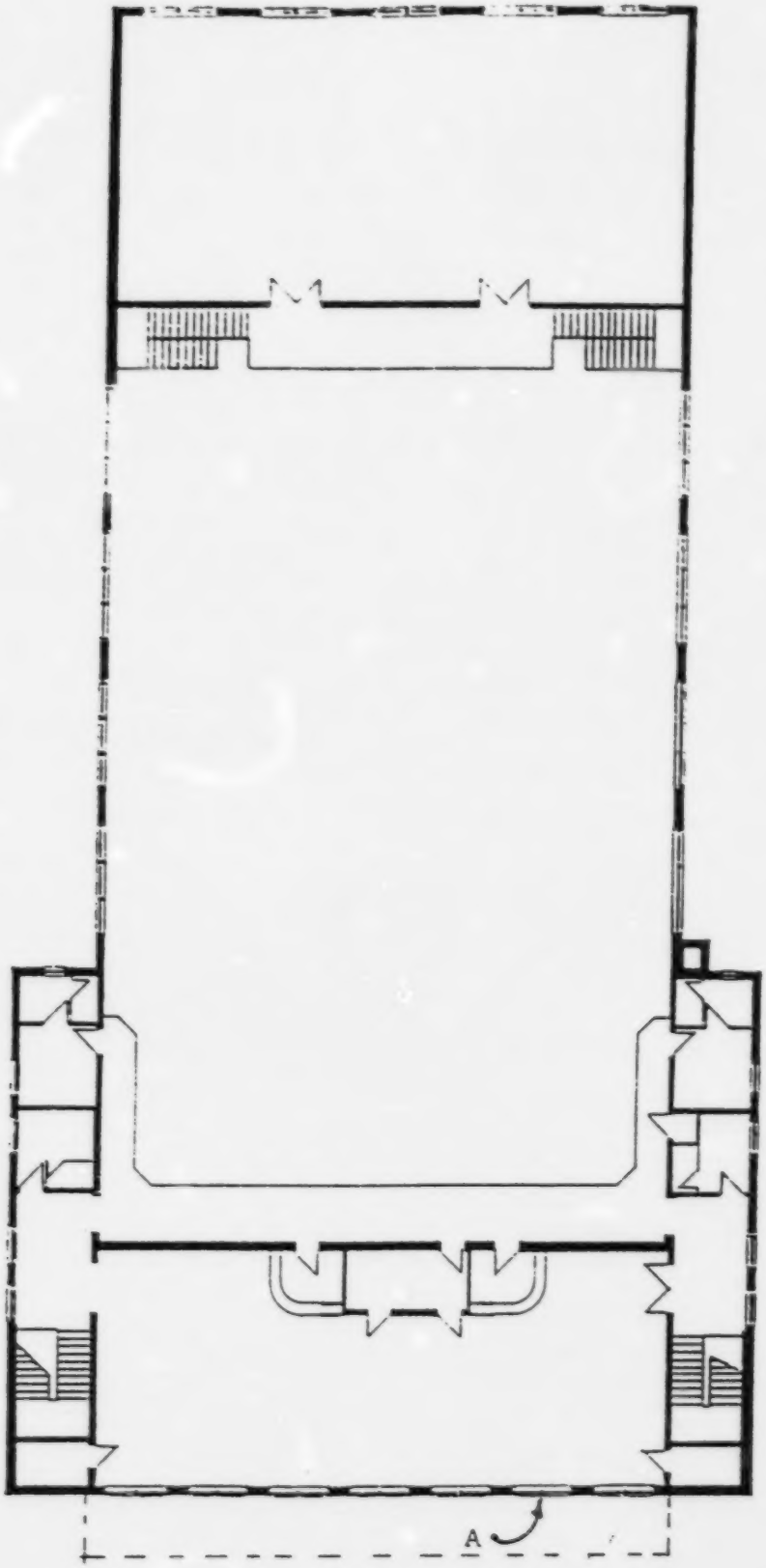
3 Mechanical Ventilation in Gym Area: If the existing windows located in the Gym Area are to be sealed or filled in in an effort to save energy through increasing the 'R' value of the building envelope, we would suggest the addition of a Ventilation System. The mechanical equipment would be located on the roof of the Gym and would consist of a supply fan, filters, dampers, ductwork and a return air fan. The control of the ventilation system would be such that it would only be operated when the area was in use. The system would be able to introduce fresh air to the Gym, from 100% down to zero (100% re-circulation) depending on the inside and outside conditions.

With the return air fan as part of the ventilation system we would be able to maintain a neutral pressure within the space relative to the outdoors.

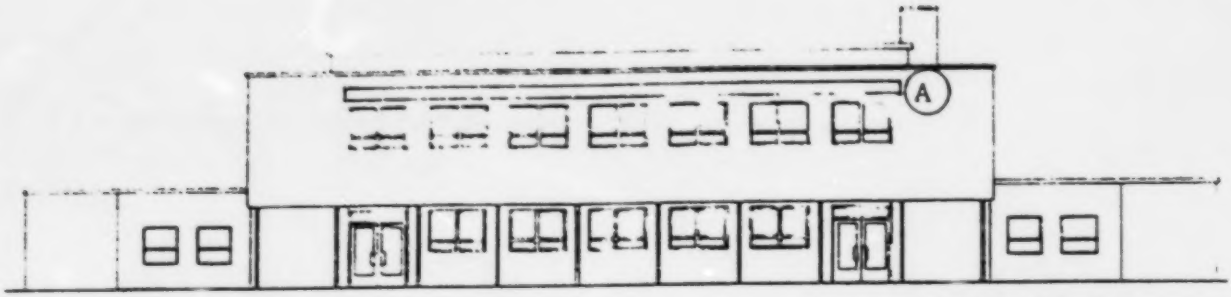
3. Mechanical Ventilation in Gym Area: (continued)

The addition of this ventilation system would not in itself save energy, however, it would provide the required ventilation if the windows were sealed and in addition the comfort level of the space would be increased.

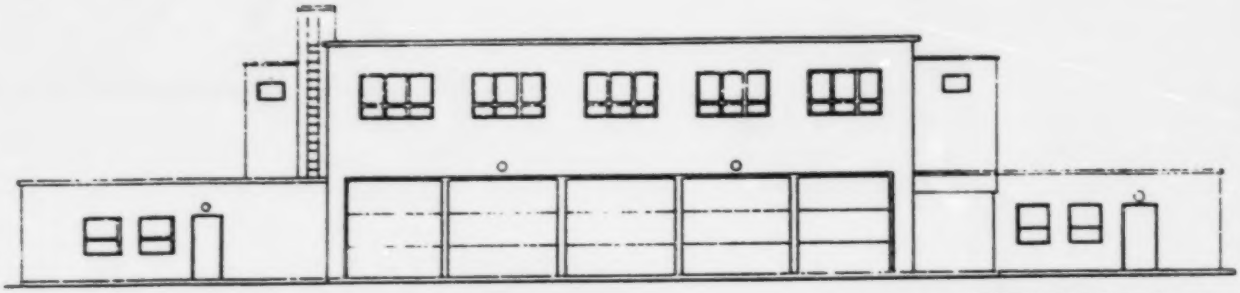
The cost of this retrofit would be approximately $12,000 installed.



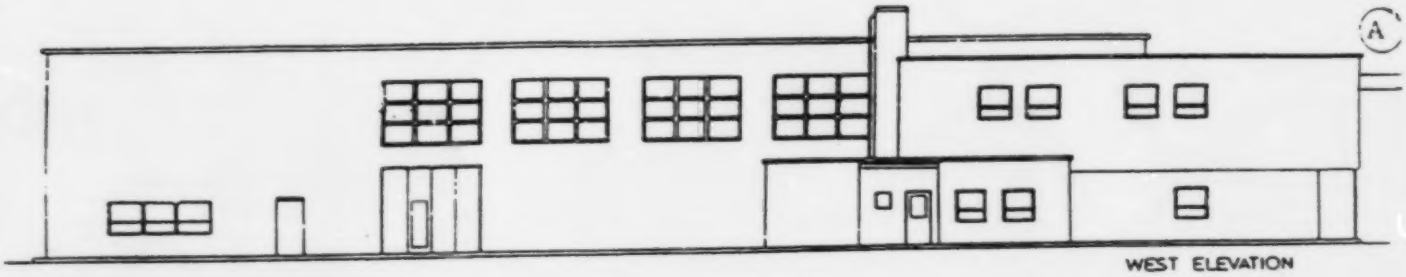
SWIFT CURRENT ARMOURIES
Second Floor Plan
Medium Cost Alternate



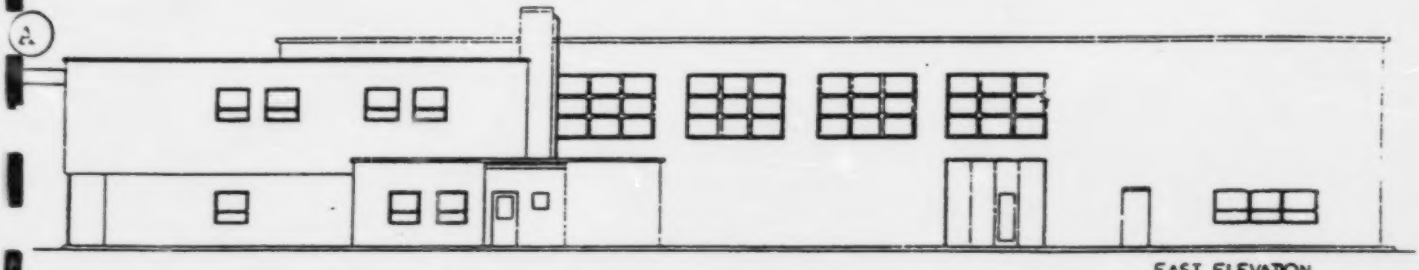
SOUTH ELEVATION



NORTH ELEVATION

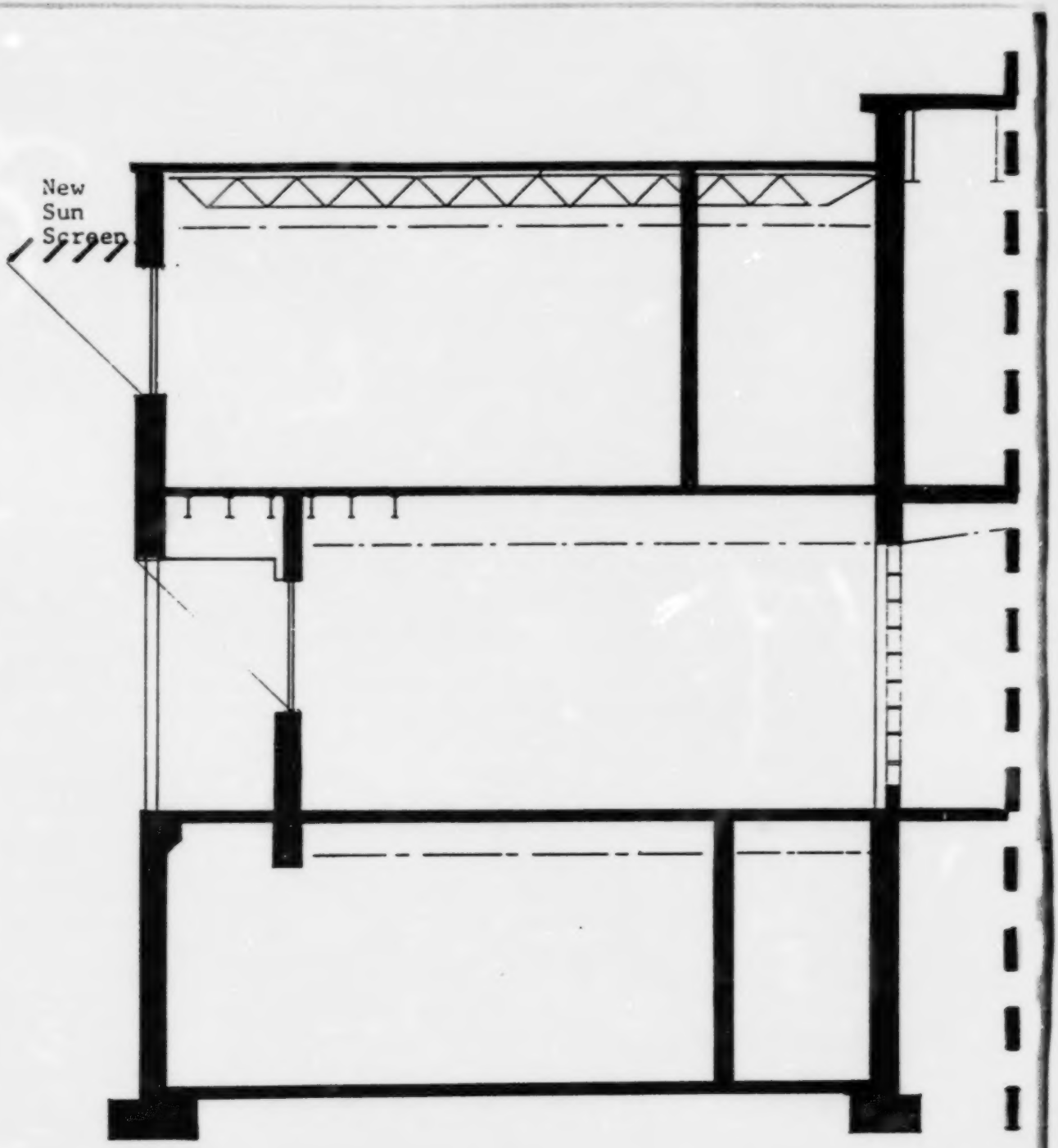


WEST ELEVATION



EAST ELEVATION

SWIFT CURRENT ARMOURIES
Elevations
Medium Cost Alternate

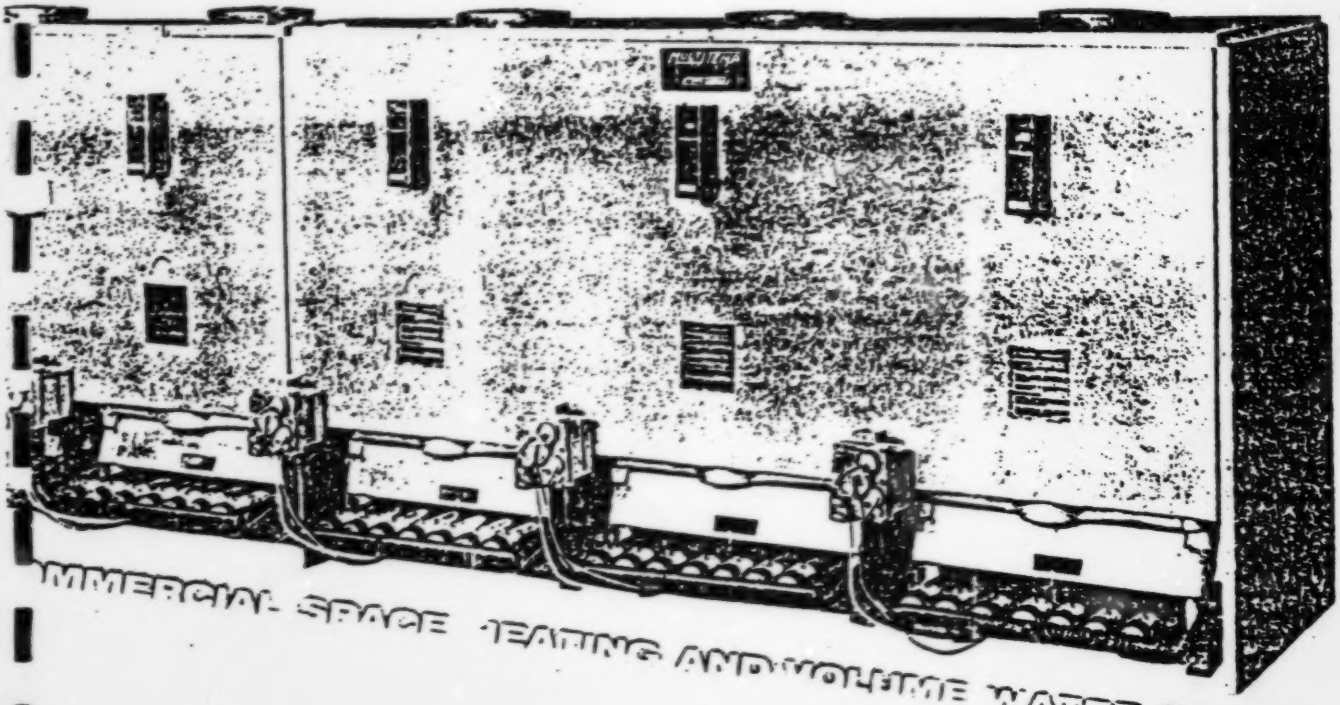


SWIFT CURRENT ARMOURIES
Sun Screen over South Wall.
Medium Cost Alternate

HYDROTHERM

Hydronic Gas Fired Heating Plants

600,000-7,200,000 Btuh



COMMERCIAL SPACE HEATING AND VOLUME WATER SUPPLY

HYDROTHERM

What it is

Multi-Temp is a cast iron modular heating plant developed by Hydrotherm, Inc. exclusively for heavy-duty, gas-fired hot water heating systems. It presents today's most advanced method for efficient utilization of gaseous fuels to provide both heat and domestic hot water for large structures such as apartment houses, office buildings, schools, churches, hospitals, etc.

Multi-Temp eliminates large boiler rooms, heavy foundations, reduces chimney costs and makes it possible to take full advantage of gas heat without paying a premium for it. All equipment passes through standard doorways, installs without rigging, and may be placed in basements, on intermediate floors, or on roof tops. Having a 100 psi ASME pressure rating, Multi-Temp can serve high-rise buildings without the use of steam convertors.

How it operates

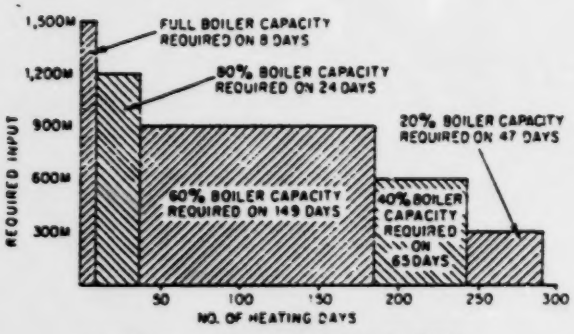
Multi-Temp takes advantage of the fact that gas can be burned cleanly, efficiently and quietly, with uncomplicated atmospheric burners. Heat transfer is accomplished with a multiple of individual cast iron heating modules, each with its own set of controls and each supplying a share of the heating load. By limiting the capacity of each heating module to 300,000 Btuh, ignition and flame supervision is accomplished with simple thermocouple-actuated safety pilots. A wide range of heating capacities can thus be obtained by selecting the correct number of standard, factory-assembled modules. Step-firing these modules automatically in relation to load conditions provides maximum efficiency.

How it saves fuel

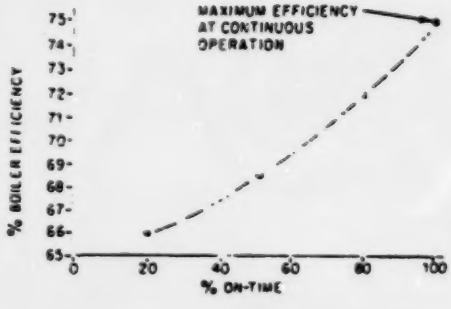
Heating boilers attain maximum efficiency only at outside design temperature at which time they are continuously operated at full rated input. Because outside design temperatures are rarely reached during the heating season, a heating system rarely operates at full capacity. Experience has shown that during 90% of the heating season, 60% or less of the heating plant capacity is required.

Single unit, large-capacity boilers must therefore operate intermittently in short combustion cycles, the length of cycle depending on load conditions. Although cycling can be reduced with "high and low" firing rates, neither condition permits the boiler to reach rated efficiency during the major part of the heating season resulting in low "seasonal efficiency".

With the Multi-Temp system, the actual heating load is matched by firing more or fewer heating modules in long operating cycles at full rated input and therefore at maximum efficiency. This in combination with low standby and pick-up losses resulting from the low mass and small water content of the heating modules, increases seasonal efficiency and thereby reduces fuel consumption by 15 to 20% of that of conventional boiler plants.



TYPICAL HEAT LOAD DISTRIBUTION IN 5600 DEGREE DAY AREA



HOW SHORT CYCLING REDUCES BOILER EFFICIENCY

How it assures safety

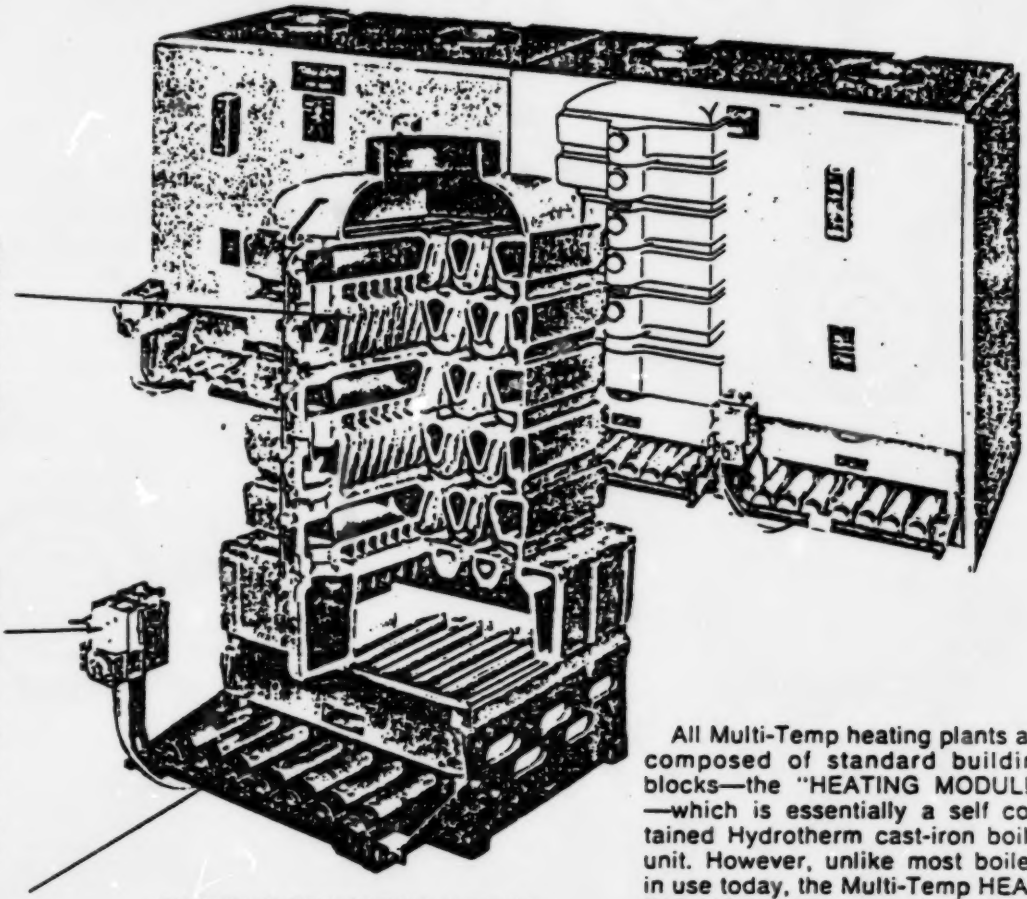
Multi-Temp heating modules assure continuous performance even if one of the modules should become inoperative. Standby capacity is thus built into every Multi-Temp heating plant and need not be provided by additional, redundant equipment. The small amount of water in each heating module is contained in comparatively small tubular passages. This prevents build up of large, potentially destructive hydraulic forces, even in the event of relief valve failure.

All heat transfer surfaces are of corrosion-proof cast iron, and are arranged above the flame bed to prevent condensation.

[illegible] Patented, 100 psi ASME rated, horizontal sections of fine-grain cast iron expose large extended surfaces at right angle to the rising flue gases, absorbing more heat per pound of cast iron than heretofore possible. These sections are guaranteed against destructive corrosion.

VALVE — 300,000 Btuh are safely controlled and regulated with this compact Honeywell combination valve, which provides programmed safe lighting and combines in a single housing the main and pilot cocks, pressure regulator and magnetic gas valve. If gas pressure fails or safety pilot extinguishes, 100% safety shut down occurs. The valve is easily serviced or replaced if required. Intermittent pilot ignition is available to serve pilot gas during "OFF" periods.

[illegible]—The burners assembled in the base are manufactured from aluminized steel and lanced to provide a controlled distribution of gas for clean and quiet combustion.



CUT-AWAY OF HEATING MODULE

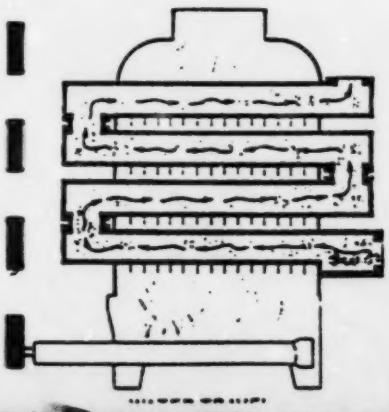
300,000 Btuh Input

Factory assembled and tested with burners and all gas controls

20" x 32" x 37" High.

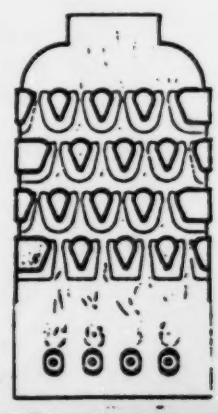
Shipping Weight:	525 Lbs.	Floor Loading:	170 Lbs./sq. ft.
Water Content	7.25 gals.	Pressure Drop (ΔT=20°)	1.1"W C
Fire Side Surface:	49 sq. ft.	Water Side Surface:	42 sq. ft.
Horsepower:	7.2 HP	Pressure Rating:	100 psi ASME

All Multi-Temp heating plants are composed of standard building blocks—the "HEATING MODULE"—which is essentially a self contained Hydrotherm cast-iron boiler unit. However, unlike most boilers in use today, the Multi-Temp HEATING MODULES are exclusively designed for hydronic systems fired with gaseous fuels and they incorporate a unique internal water circulation pattern which permits parallel operation of any desired number of Heating Modules with a single circulating pump. By designing exclusively for hot water systems—not steam — no design compromises were required and the most efficient concept for hot water heating systems could be applied.



DESIGN PRINCIPLE

The MULTI-TEMP heating module embodies the patented and well proven all cast iron Hydrotherm Heat Exchanger with horizontal boiler sections, which expose large deep ribbed surfaces for convective heat transfer at right angle to the rising gases. This true gas design results in a 40% greater heat transfer than obtainable with conventional multi-purpose, vertical section boilers. All boiler sections are arranged above the combustion zone and are connected by malleable iron nipples at alternate ends only. This forces the boiler water to travel a zig-zag path from section to section creating a natural thermal drive and assuring uniform heat transfer without hot spots, condensation, internal stresses or thermal shock. Most important, this circulation pattern results in equal, predictable pressure drop across each heat exchanger which is necessary to operate multiple heating modules in parallel.



HIGH COST RETROFIT

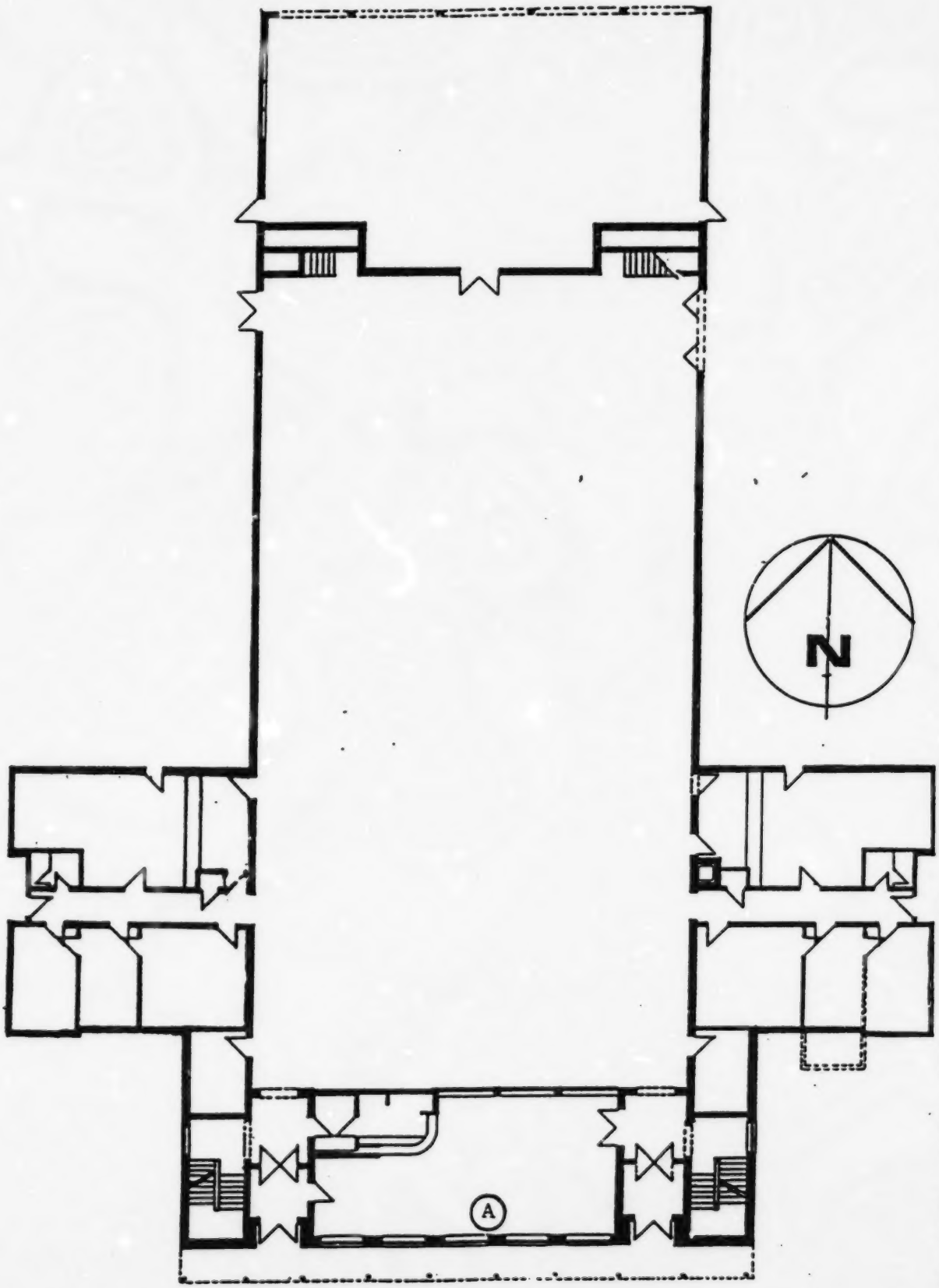
A. ARCHITECTURAL

Various refinements and improvements can be made to this basically sound building. From the Thermal Scan one can observe a certain amount of leakage along the flashing.

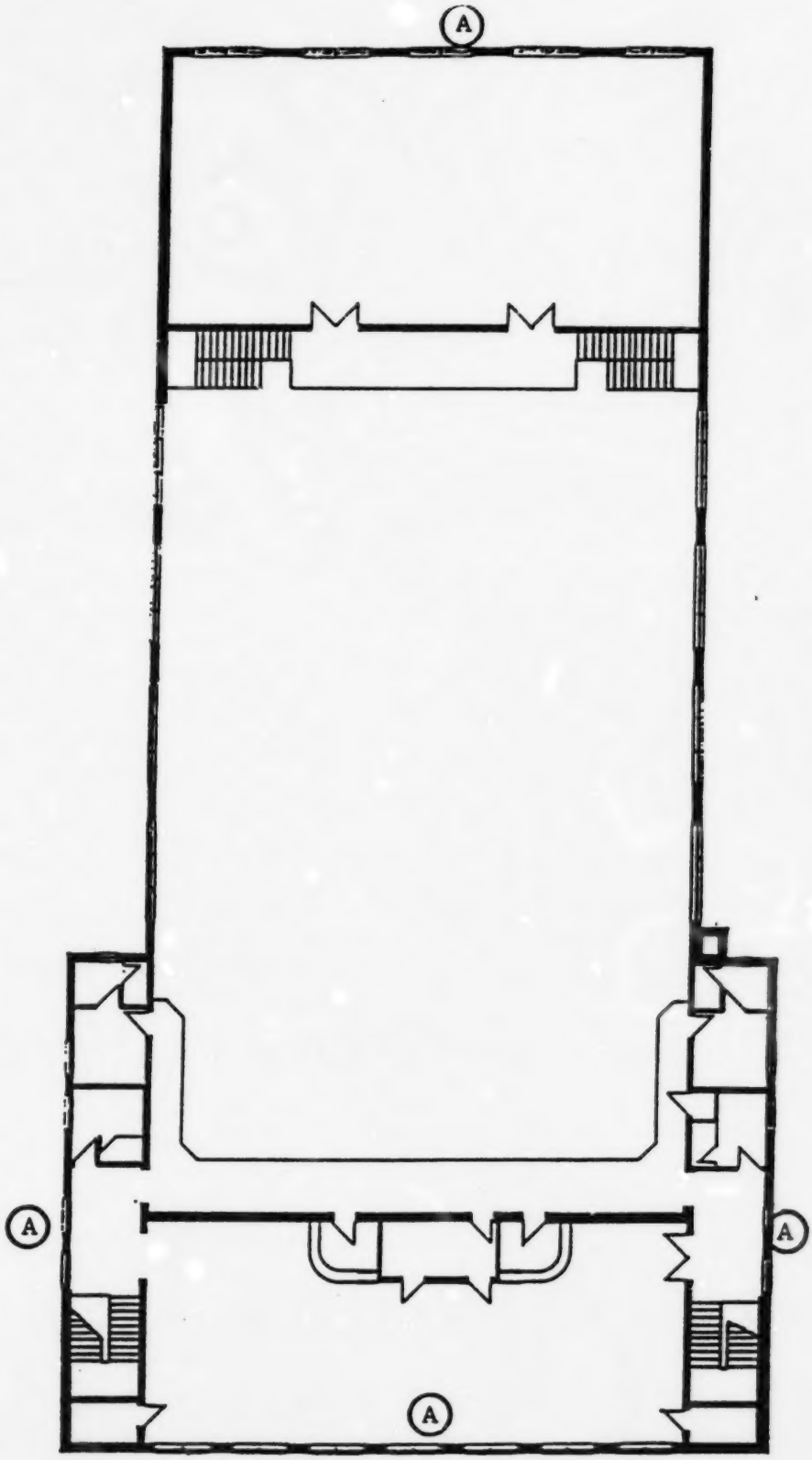
1. It should be noted that there exists no insulation above the suspended ceilings and it is difficult to ascertain whether lounges and upper toilets have wall insulation (see attached sketch page 47.) To rectify the obvious heat leak above the ceilings one can insulate above the ceilings and provide a continuous vapor barrier from roof to floor - however, this will entail the removal of present plaster ceiling. In the gymnasium area, this can be accomplished by using an insulating sealant at the roof/wall intersection. Taking note that the remainder of the wall structure is uninsulated, it could be deemed warranted, in keeping with current practice, to increase the insulating value of the total assembly by adding to the exterior of the building 2" rigid insulation and stucco (see A page 46 and detail page 48) The total estimated cost of the above would be about $26,250. (This amount could be considerably higher if tests show that the lounges, toilets and stairwells are also not insulated.

   Savings indicated are 949 MCF or $2,856 with a payback period of 9.2 years.

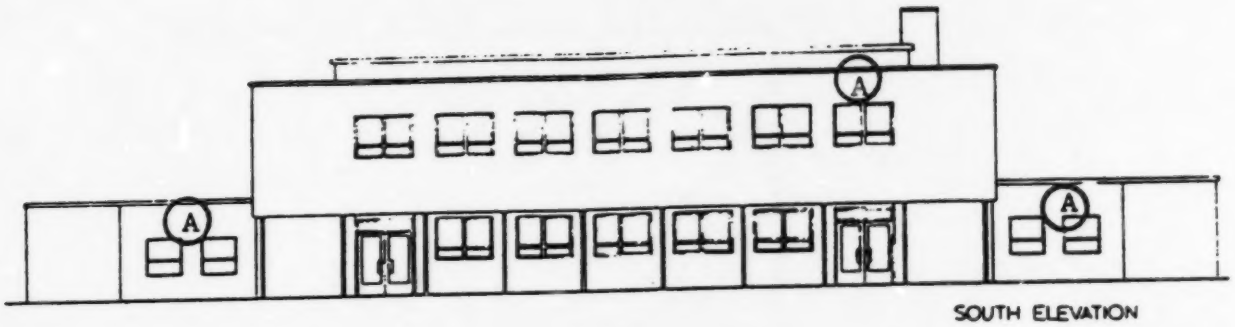
2. Together with the upgrading of the exterior wall we recommend that the roof be upgraded with the addition of a 6" layer of rigid insulation to top of existing roofing (with gravel mostly swept off) painted with a white exterior latex paint and held in place with a row of patioblock along the perimeter and single blocks at the junctions of 4 panels. The cost should not exceed $16,460 and the anticipated annual saving should be approximately 354,000 MBTU or about $1,066 which indicates a straightline payback of 15.5 years.



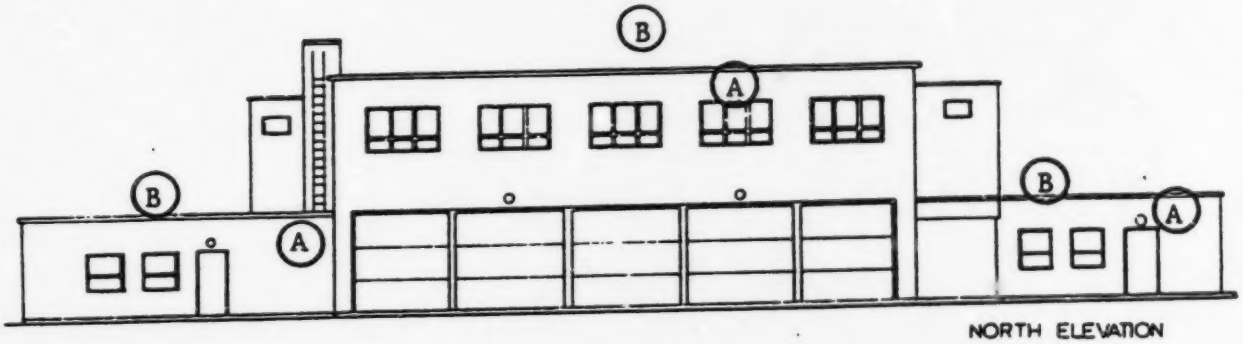
SWIFT CURRENT ARMOURIES
Ground Floor Plan
High Cost Alternate



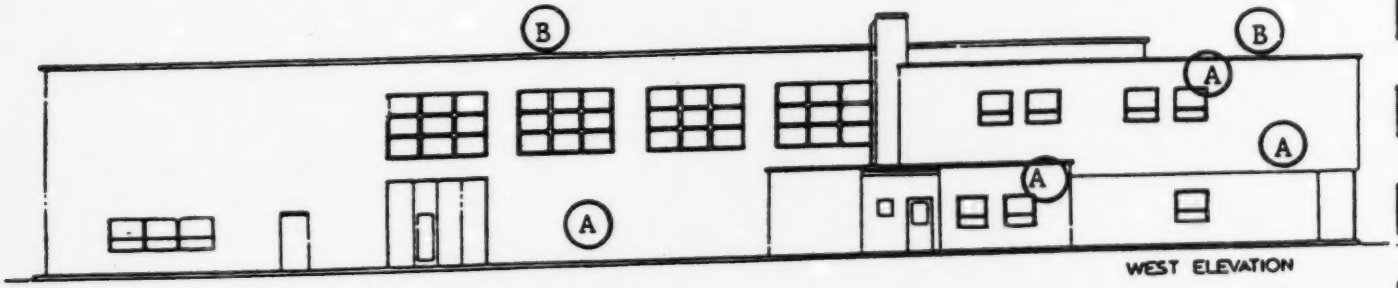
SWIFT CURRENT ARMOURIES
Second Floor Plan
High Cost Alternate



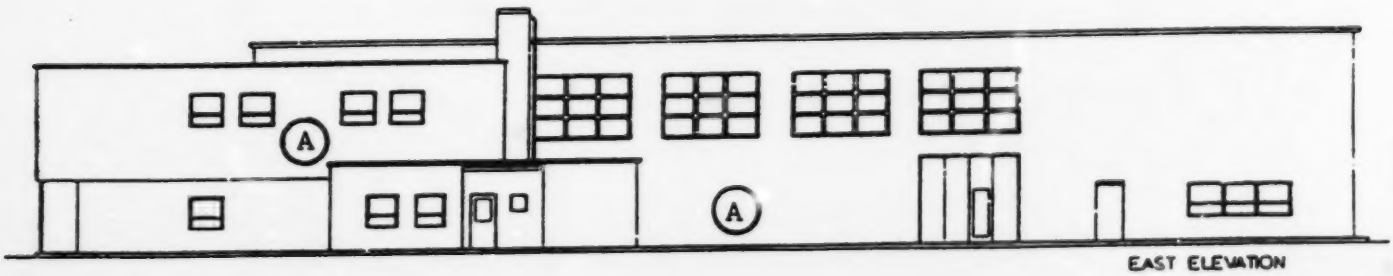
SOUTH ELEVATION



NORTH ELEVATION



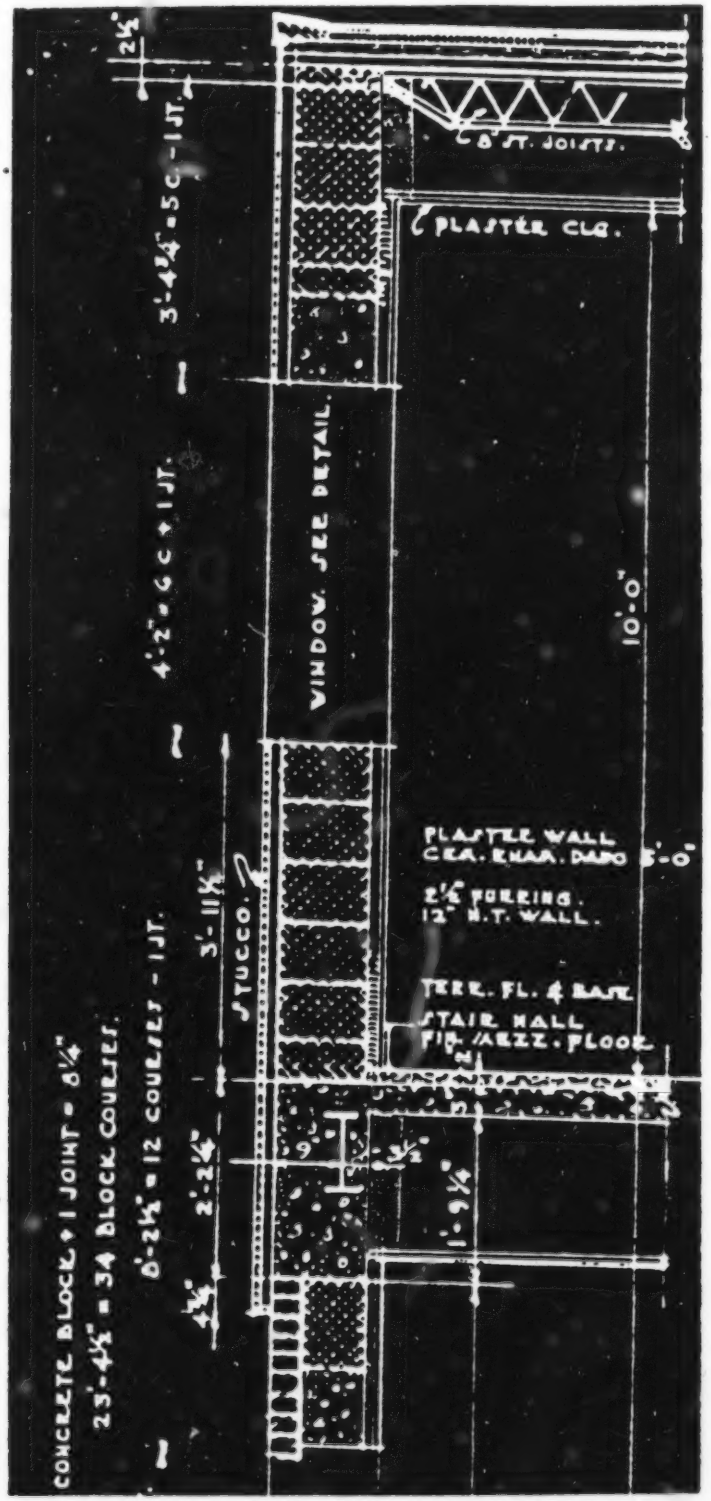
WEST ELEVATION



EAST ELEVATION

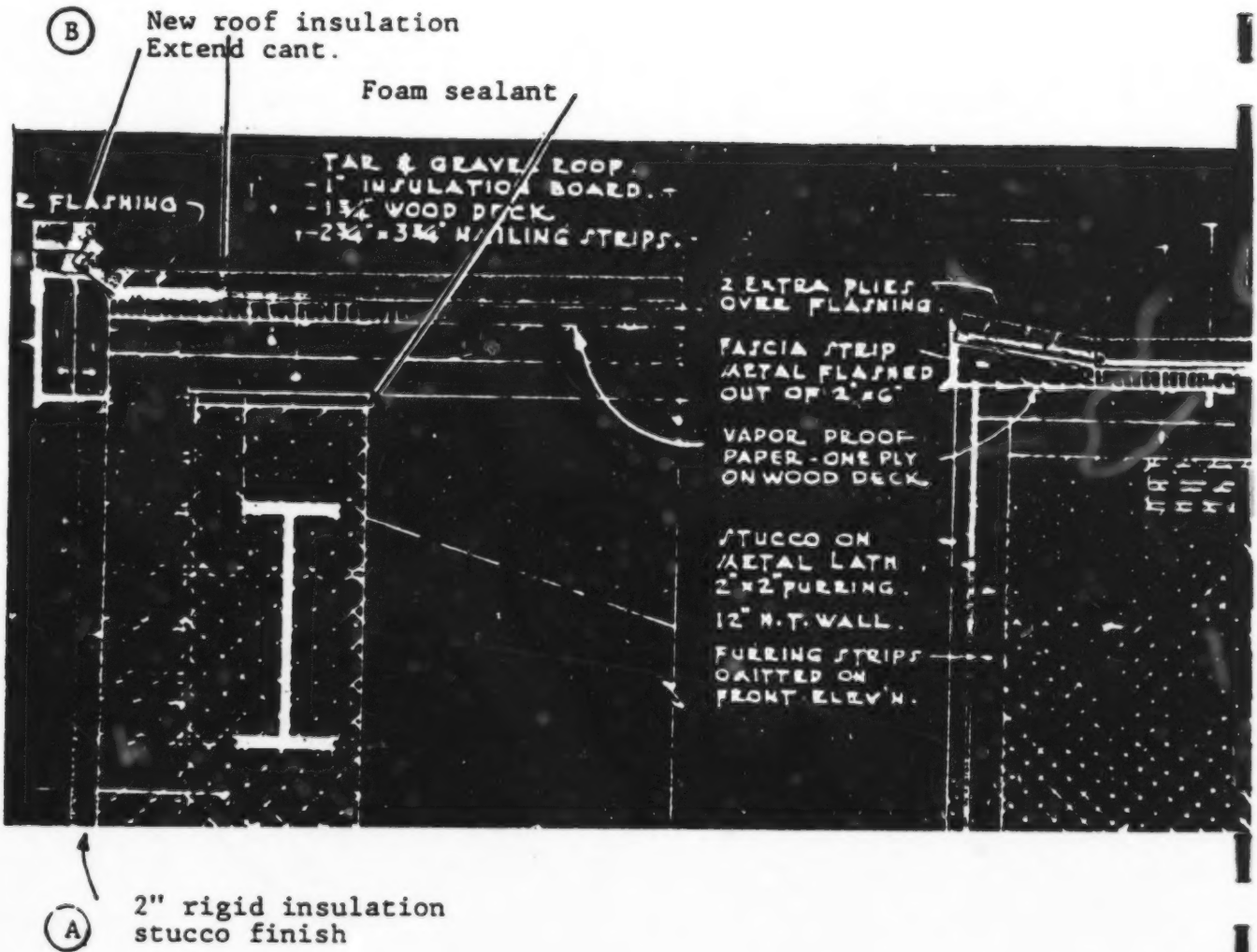
SWIFT CURRENT ARMOURIES
Elevations
High Cost Alternate

add 2" rigid insulation
and vapor barrier.....



add 2" rigid insulation
and vapor barrier.....

SWIFT CURRENT ARMOURIES (A)
High Cost Alternate
Ceiling space insulation.


B
New roof insulation
Extend cant.
Foam sealant
TAR & GRAVEL ROOF.
- 1" INSULATION BOARD.
- 1¾" WOOD DECK
- 2¾" x 3¾" NAILING STRIPS.
2 EXTRA PLIES OVER FLASHING.
FASCIA STRIP METAL FLASHED OUT OF 2" x 6"
VAPOR PROOF PAPER - ONE PLY ON WOOD DECK.
STUCCO ON METAL LATH 2" x 2" FURRING.
12" N.T. WALL.
FURRING STRIPS OMITTED ON FRONT ELEV'N.
A
2" rigid insulation
stucco finish

SWIFT CURRENT ARMOURIES
High Cost Alternate
Roof/Wall details

NEW AND INNOVATIVE RETROFIT

A. ARCHITECTURAL

Consideration should be given to including in the south face sun screen a full width application of Solar Kal air heater units to heat the lounge and bar areas (2 levels). Cost of screen and related material and equipment installed based on 64" x 8" is approximately $13,800.

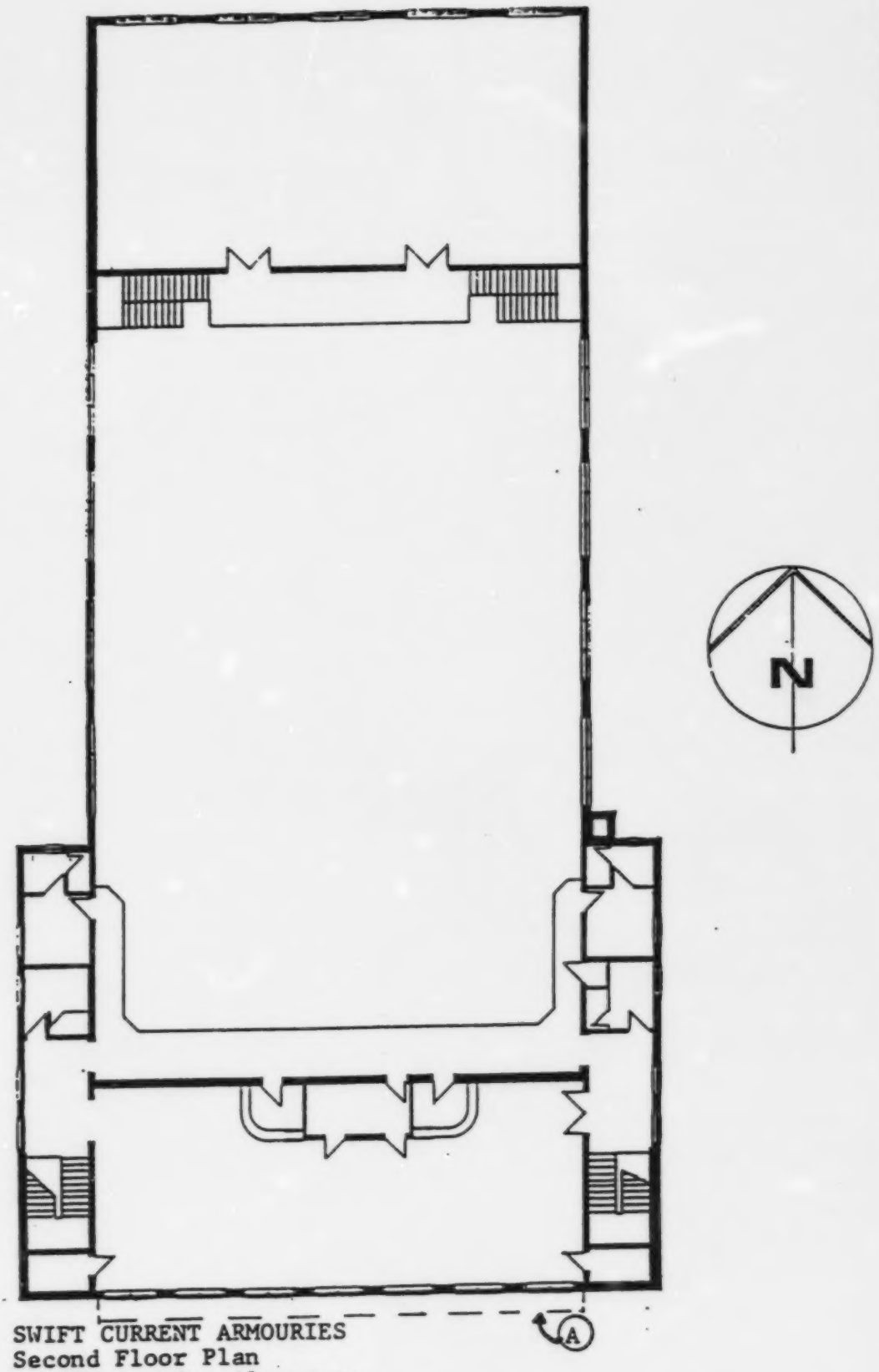
Note: Although solar space heating has a relatively high capital cost for the amount of return available at present and probably no payback, we have included this item as technically the building orientation and height are ideal for this application.

B. MECHANICAL

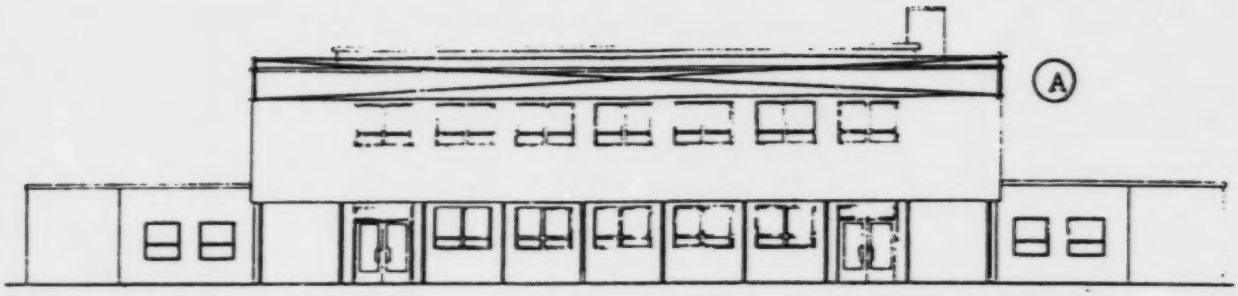
1. The items that come to mind on this topic are: Alternate Energy Sources, Computerized Energy Management, Energy Storage Systems, and Extracting Energy from Waste Heat.

   Because of the size and operation of the building none of the items are practical or even worth considering.

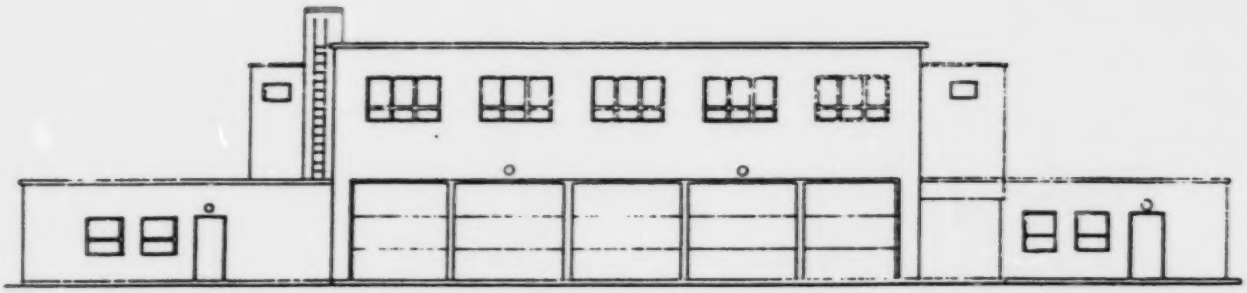
   There are no alternate energy sources in the area that would show a savings in operating costs at this time, the size of the building eliminates the usefulness of any type of computerized energy management and energy storage system, and because of the limited amount of exhaust involved in the operation of the building heat extraction would be completely impractical.



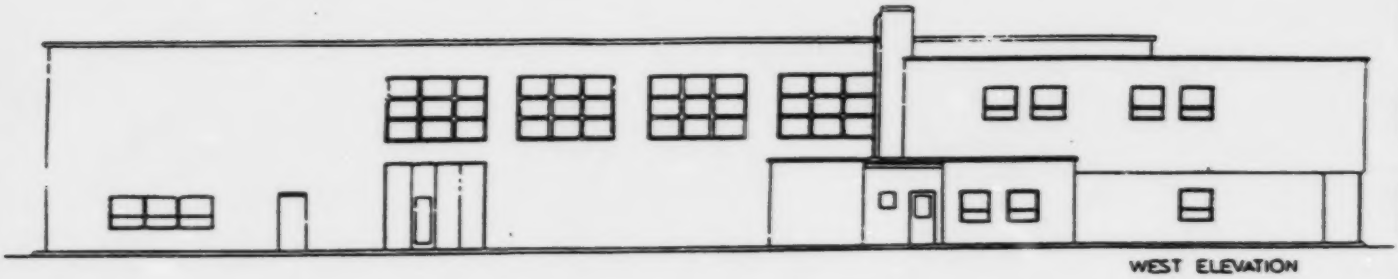
SWIFT CURRENT ARMOURIES
Second Floor Plan
New/Innovative Alternate



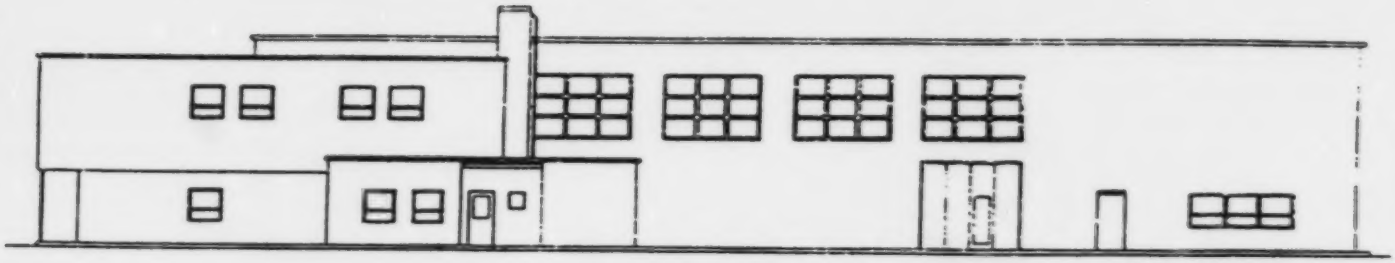
SOUTH ELEVATION



NORTH ELEVATION



WEST ELEVATION

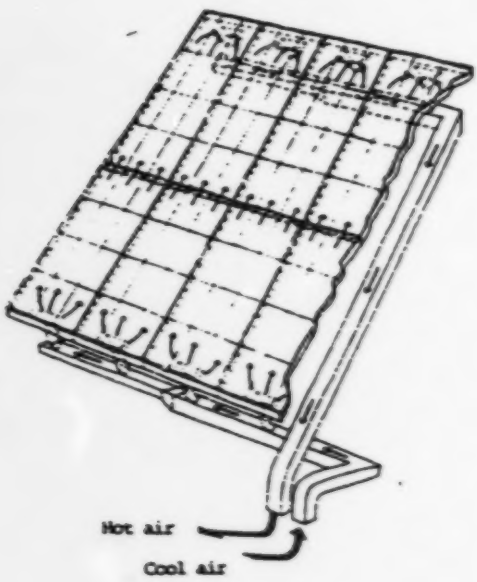


EAST ELEVATION

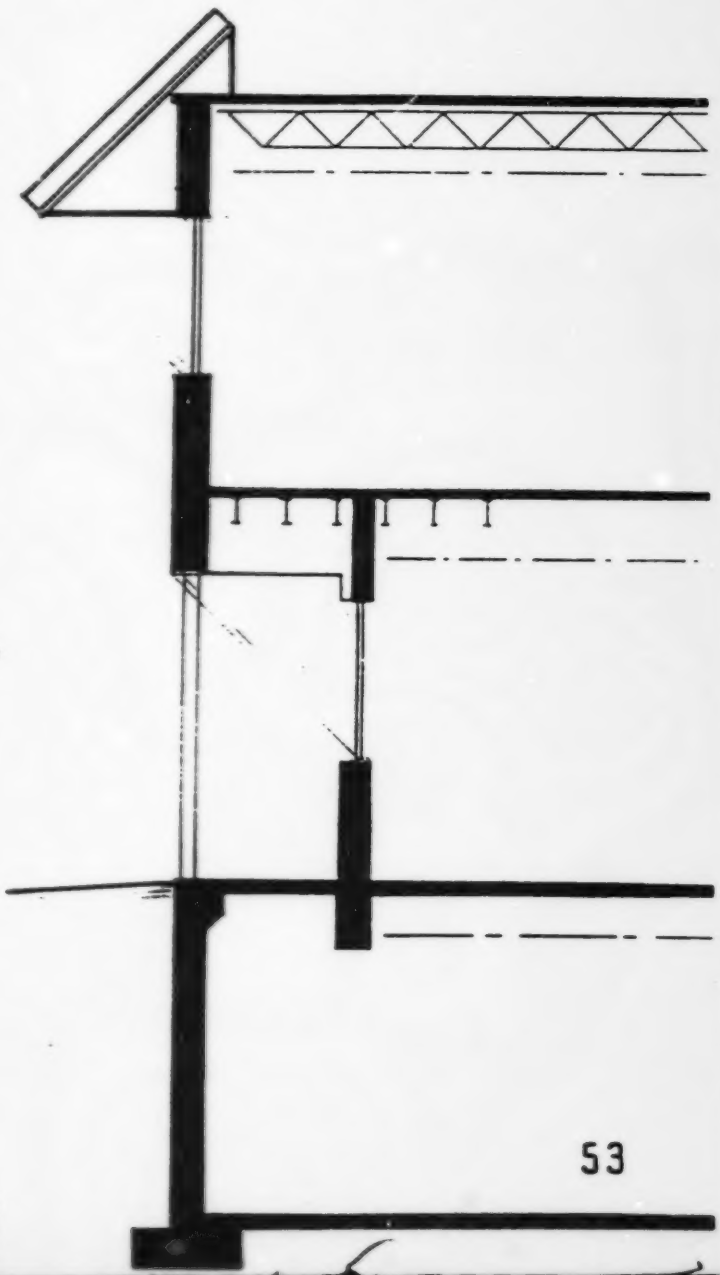
SWIFT CURRENT ARMOURIES
Elevations
New/Innovative Alternate

SOLAR-KAL
Air heater

Solar transmission 77%
U factor with duct ports sealed is .36 BTU/hr/^{0}/sq.ft.



SWIFT CURRENT ARMOURIES
Innovative/New (A)



RECOMMENDATIONS

A.	ARCHITECTURAL		
	1.	All no cost items	
		cost	$1,200
	2.	Low cost items	
		-Paint and seal	4,900
		-Insulated Filon Panels	4,800
		-Basement Insulation	1,050
	3.	Medium Cost	
		-Sun screen	7,000
	4.	High Cost	
		-Exterior Insulation	26,250
		-Roof insulation	16,460
	5.	New and Innovative	13,800
B.	MECHANICAL		
	1.	All no cost items	700
	2.	Low Cost	
		-Boiler Controls	1,000
		-Anti-stratification Fans	3,000
	3.	Medium Cost	
		-Automatic Temperature Controls *priority	7,500
Total for items recommended for inclusion in Phase Two			$87,660

CONCLUSIONS

The building appears to be excellently managed, in relatively good condition and the mechanical system would appear to be operating properly.

The yearly energy usage for this building is actually very low and this is quite possibly due to the heatsink effect of the massive concrete floor structure and the shooting range extending under the gymnasium.

Most changes therefore are relatively minor. The No-cost items and the automatic controls should be carried out without question as these items are of modest cost and result in excellent energy savings and aid in other reductions in management costs.